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D D P H H

Letter from the
Editor's Desk

Dear readers

Our team of officials working for the journal, ensure that the articles are published with short turnaround time possible with their extraordinary efforts in addition to their regular duties in the directorate. I like to thank each and every member of the editorial board in this regard. It is done purely because of their love towards science.

As usual we covered the entire range of topics from communicable to noncommunicable disease which will give a meaningful information not only to the scientific community but also to the common man which is the ultimate aim of the science.

We are happy to announce that, the new editorial board for the journal is formed and they are taking over from this edition and I like to extend my best wishes to them.

We are also happy to announce that very soon we will be going for an exclusive portal to manage the end to end activities from article submission to publication online with critical timelines for each activity.

Best wishes. Happy reading. Thanks for your support.

Dr. T.S.Selvavinayagam MD., DPH., DNB.,

Director of Public Health & Preventive Medicine

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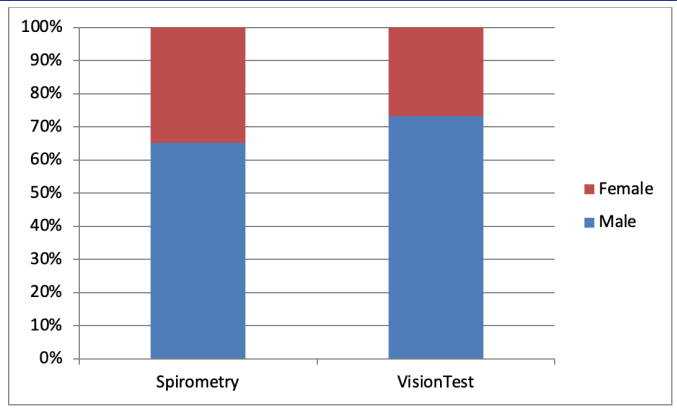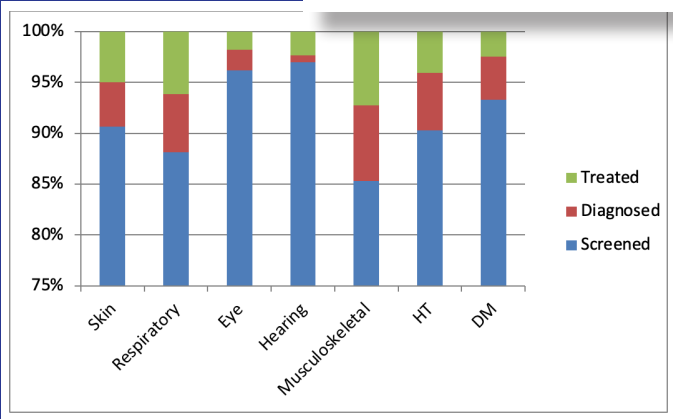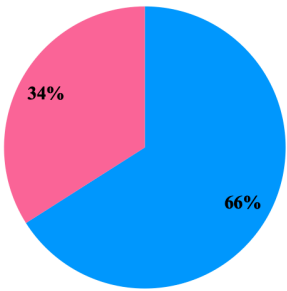**Figure 1: Gender**

RESEARCH IS TO SEE WHAT EVERYBODY ELSE HAS SEEN, AND TO THINK WHAT NOBODY ELSE HAS

ORIGINAL ARTICLE - PUBLIC HEALTH

RETROSPECTIVE STUDY OF DOG BITE CASES REPORTED IN TAMIL NADU FROM JANUARY 2022 TO DEMEBER 2023.

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Abstract

INTRODUCTION : Dogs have the potency to cause a multitude of health problems to humans when not maintained well. Over the years, the dog population and dog bite cases have increased. Measures to prevent rabies have increased the financial burden on the community and healthcare system.
AIM : To describe the epidemiology of dog bite cases reported in Tamil Nadu.
METHODOLOGY : This retrospective secondary data analysis was conducted among Dog bite cases reported in Tamil Nadu from January 2022 to December 2023 through IHIP-IDSP platform. The collected data was analyzed using SPSS version 21.
RESULTS : The reported number of dog bite cases increased by 18.1% in 2023 compared to 2022 and maximum cases were reported during May and June. Males contributed to 35% of cases more than females. Among the cases 98.1% were provided PEP in OPD care and approximately 62% of the cases sought care at Primary healthcare institutions.
CONCLUSION : With the increasing burden of strayed dogs and dog bite cases, the requirement of post-exposure prophylaxis(PEP) for rabies infection is increasing. Hence government needs an holistic approach to control the dog population by Animal Birth Control measures (ABC) to prevent the financial burden on healthcare institutions and the cases of dog bites.
KEYWORDS : Dog bites, Post exposure prophylaxis, Integrated disease surveillance programme.

INTRODUCTION

Human-animal bite injuries are a significant health problem. Every year, about 1% of emergency department visits worldwide are due to animal bites, which can cause virtually anything from minor scratches to severe, sometimes fatal wounds. Infection can occur in even relatively minor wounds.[1] Because of this, every bite must be examined vigilantly, and any potential consequences should be handled vigilantly Globally, dog and cat bites are the most common animal bites, making up nearly 95% of all bite wounds seen in the emergency room.[2]

Dogs are the most loved pets in India and also the most common pets abandoned. This has led to a significant increase in dog straying, leading to an unaccounted dog population. The increase in dog population led to increased dog bites over the years.[3] Several incidents of dog bites by strayed dogs have been reported during the past decade, and the number keeps increasing. Due to the potential for exposure to the rabies virus, particularly in developing countries where rabies is an endemic disease, human-animal bite injuries represent a significant public health concern.[4,5]

Dogs are the primary source for 85 to 90% of human-animal bite injuries, followed by cats (5 to 10%). Numerous studies have shown that dogs cause between 76 and 94% of animal bite injuries in low-income nations, which leads to a high frequency of rabies.[6,7] Children (5 to 9 years old) are the most likely to suffer from animal bites. Children under the age of 15 are one of the most significant at-risk populations

for rabies, according to a WHO research.[8]

The findings of various research carried out throughout multiple regions of India suggest that there has been a rising trend in the number of animal bites in our nation in recent times.[9] In the previous study conducted by officials in DPH&PM, the number of rabies deaths was stable but the number of dog bites was high. As we are focusing on eliminating rabies, it is important to focus on preventive and control measures. Among rabies death cases, pet dogs were the major source of rabies infection.[10,11] The epidemiology of dog injuries and their consequences for public health need to be continuously monitored in light of the rise in dog ownership and stray dog populations in India, as well as the changing traits of both dog owners and canines.[12,13]

This study assessed the time, place, and person distribution of dog bites in Tamil Nadu reported in the Integrated Health Information Platform - Integrated Disease Surveillance Programme (IHIP-IDSP).

METHODOLOGY

This descriptive secondary data analysis was conducted in Tamil Nadu between April and May 2024.

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This study assesses the epidemiological profile of dog bite cases from January 2022 to Demeber 2023. Dog bite case details were collected from the IHIP-IDSP collected by the Communicable Disease section of the Directorate of Public Health and Preventive Medicine (DPH&PM).

The National Centre for Disease Control (NCDC) uses IHIP-IDSP as a standard real-time surveillance platform to monitor all diseases that are notifiable and have public health importance. Dog bites and other animal bites are among the incidents recorded in the IHIP-IDSP, which includes a set up of case epidemiological profiles.

Cases of dog and animal bites are reported through the IHIP-IDSP platform using the P form or presumptive case form. Information was collected from the platform, and bites unrelated to dogs were excluded. The collected data was entered in Microsoft EXCEL and analyzed using SPSS version[21]. Age was grouped into 10 with a class interval of 10 years. Continuous variables are expressed as mean and standard deviation. Categorical variables are expressed as frequency and percentage. All dog bite cases are considered major public health concerns, and appropriate response measures must be initiated to prevent an outbreak. Prior official permission to conduct this study was obtained from the DPH&PM. To maintain the privacy of the cases, their names were kept a secret, and the initials were used alone for the study.

RESULTS

The distribution of dog bite cases reported from Tamil Nadu in the IHIP-IDSP p-form from January 2022 to Demeber 2023 is described in Table 1. During the study period, 8,06,239 dog bite cases were reported in Tamil Nadu (2022 - 3,65,318 and 2023 - 4,40,921). Among the dog bite victims, males contributed 60.2% (n=4,85,622). Similarly, among the age group distribution, dog bites were most prevalent in adults in the age group 41-50 years (16.3%) and 31-40 years (16.2%), followed by children ≤10 years (15.4%).
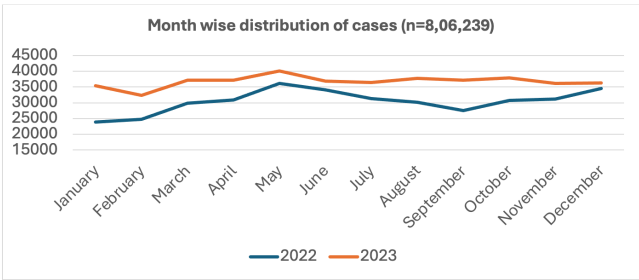
Figure 1: Month-wise distribution of dog bite cases in Tamil Nadu from January 2022 to Demeber 2023 (n=8,06,239).

Table 1: Age-sex distribution of dog bite cases in Tamil Nadu from January 2022 to Demeber 2023 (n=8,06,239).

Age group	Female		Male		Transgender		Grand Total	
	Number of cases	Percentage	Number of cases	Percentage	Number of cases	Percentage	Number of cases	Percentage
≤10 years	45,092	14.1%	79,148	16.3%	57	17.1%	1,24,297	15.4%
11-20 years	39,541	12.3%	77,852	16.0%	46	13.8%	1,17,439	14.6%
21-30 years	43,602	13.6%	76,986	15.9%	44	13.2%	1,20,632	15.0%
31-40 years	55,413	17.3%	75,063	15.5%	48	14.4%	1,30,524	16.2%
41-50 years	57,534	18.0%	74,095	15.3%	63	18.9%	1,31,692	16.3%
51-60 years	46,323	14.5%	58,811	12.1%	45	13.5%	1,05,179	13.0%
61-70 years	23,855	7.4%	30,216	6.2%	19	5.7%	54,090	6.7%
71-80 years	6,677	2.1%	10,074	2.1%	9	2.7%	16,760	2.1%
81-90 years	1,530	.5%	2,216	.5%	2	.6%	3,748	.5%
≥91 years	717	.2%	1,161	.2%	0	0.0%	1,878	.2%
Total	320284	100.0%	485622	100.0%	333	100.0%	806239	100.0%

Figure 1 describes the month-wise distribution of dog bite cases in Tamil Nadu during the study period. The number of dog bite cases is almost constant over the year, with a slight increase in cases during the month of May (9.5%) and December (8.8%).

Table 2: Age-year distribution of dog bite cases in Tamil Nadu from January 2022 to Demeber 2023 (n=8,06,239).

Age group	2022		2023		Grand Total	
	No. of Cases	Percentage	No. of Cases	Percentage	No. of Cases	Percentage
≤10 years	58,609	16.04	65,688	14.90	1,24,297	15.42
11-20 years	52,945	14.49	64,494	14.63	1,17,439	14.57
21-30 years	55,405	15.17	65,227	14.79	1,20,632	14.96
31-40 years	59,484	16.28	71,040	16.11	1,30,524	16.19
41-50 years	58,693	16.07	72,999	16.56	1,31,692	16.33
51-60 years	46,693	12.78	58,486	13.26	1,05,179	13.05
61-70 years	23,618	6.47	30,472	6.91	54,090	6.71
71-80 years	7,426	2.03	9,334	2.12	16,760	2.08
81-90 years	1,655	0.45	2,093	0.47	3,748	0.46
≥91 years	790	0.22	1,088	0.25	1,878	0.23
Total	3,65,318	100.00	4,40,921	100.00	8,06,239	100.00

Table 2 describes the age-wise distribution of dog bite cases in Tamil Nadu between the years 2022 and 2023. The number of dog bites among persons over 80 was lower. In 2023, there were more reported dog bites across all age groups than there were in 2022.

Figure 2 describes the distribution of dog bite cases District (HUD)-wise between the years 2022 and 2023. The number of dog bite cases in 2023 (54.69%) was higher than in 2022 (45.31).

Among the HUDs, most cases were reported from Salem (8.2%) followed by Vellore (6.39%) and Tiruchirappalli (5.76%), and the least was reported from Perambalur (0.5%) and The Nilgiris (0.57%).

Figure 2: District-wise distribution of Dog bite cases in Tamil Nadu from January 2022 to Demeber 2023(n=806239).
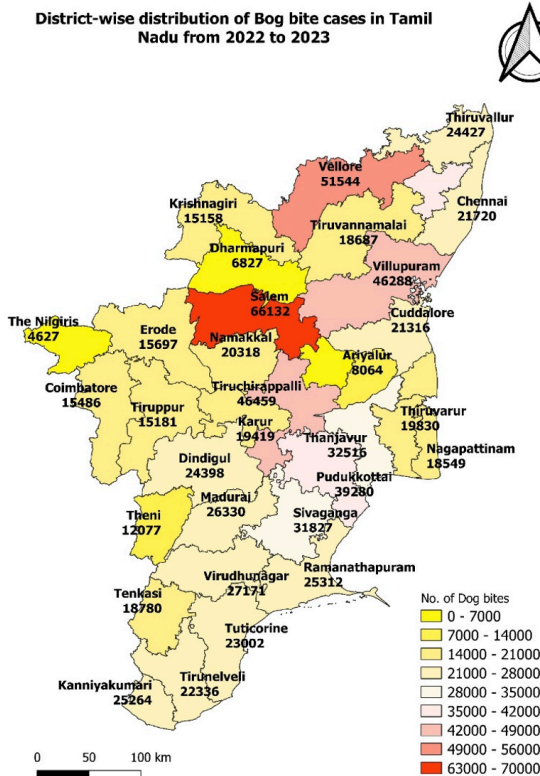

Table 3 describes the place of contact for first aid following dog bites in Tamil Nadu from January 2022 to December 2023. Following a dog bite, primary healthcare facilities (62.47%) are the most frequently used facilities for administering first aid; private institutions (0.17%) are the least frequently used locations. In the outpatient department (OPD), 98.2 percent (n=7,90,292) of the dog bite cases received first aid.

The number of reported dog bites in IHIP-IDSP was 8,06,239. The post-exposure prophylaxis included the Anti-rabies vaccine (1 vial = 209 Rupees with 5 doses), Tetanus toxoid administration (1 vial = 106 Rupees with 20 doses) and assuming 10% of bites are Category III requiring Rabies Immunoglobulin (1 vial = 263 Rupees) and including the loss of wages on the day of visiting the hospital for post-exposure prophylaxis care (assuming 1-day wage as 272 Rupees for 4 days). The calculated financial burden on post-exposure prophylaxis including loss of wages for the study period was Rupees. 94 crores which is recurrent over the years and increases with increasing dog bites.

According to the data from the 20th Livestock Census for the dog population in Tamil Nadu released in the year 2020, the total dog population in Tamil Nadu was 12,97,230. As the exact number of dogs neutered under the Animal Birth Control program, we assumed 50% of

dog population are to be neutered. The cost of the Animal Birth Control procedure for one dog was Rupees 1,650, which included Rupees 1,450 for the procedure and Rupees 200 for the dog catcher. The calculated financial burden on the Animal Birth Control program was Rupees. 107 crores excluding the dog vaccination expenditure.

Table 3: Type of healthcare facility approached for first aid among dog bite cases in Tamil Nadu from January 2022 to Demeber 2023 (n=8,06,239).

Health Care Facility	2022		2023		Total	
	Np. Of Cases	Percentage	Np. Of Cases	Percentage	Np. Of Cases	Percentage
Primary Health Care Institute	2,31,700	28.74	2,71,944	33.73	5,03,644	62.47
Community Health Center	68,450	8.49	80,277	9.96	1,48,727	18.45
Mobile Medical Unit	1,158	0.14	880	0.11	2,038	0.25
Primary Health Center	1,60,913	19.96	1,90,348	23.61	3,51,261	43.57
Rashtriya Bal Swasthya Karyakram	1,179	0.15	439	0.05	1,618	0.20
Secondary Health Care Institute	1,14,333	14.18	1,35,022	16.75	2,49,355	30.93
District Head Quarter Hospital	20386	2.53	21603	2.68	41989	5.21
Sub District Hospital	93,947	11.65	1,13,419	14.07	2,07,366	25.72
Tertiary Health Care Institute	18,516	2.30	33,339	4.14	51,855	6.43
Medical College Hospital	18,516	2.30	33,339	4.14	51,855	6.43
Private Institute	769	0.10	616	0.08	1385	0.17
Grand Total	3,65,318	45.31	4,40,921	54.69	8,06,239	100.00

DISCUSSION

This study has found that the number of dog bite cases in Tamil Nadu has been increasing. This increase is evident both in the State and district-level analysis. The increase in dog bites was apparent in all age groups. Studies carried out in the United States, Canada, Uganda, Switzerland, and India produced similar results. This suggests that when dog bites are on the rise, all age groups are more vulnerable.[3,9,14–18] This could indicate the increasing number of dog populations.

In our study, dog bite cases were more prevalent among males than females. Males aged 41 to 50 were the most common victims of dog bites, followed by those aged <10 years. Among the entire population, ages between 41-50 years followed by 31 to 40 years were the vulnerable population. Similar findings were observed in studies from India, the USA, Canada, and Uganda.[18–20] In contrast to our study, a study conducted in Salem in Tamil Nadu showed higher prevalent in the age group less than 15 years.[3] This high prevalence in the adolescent age group could be due to the high exploring nature in this age group and the affection towards pets in that particular age.

According to our study, more dog bite incidents were reported in males than females. Global research projects, including those in the USA, Canada, Uganda, Belgium, and India, have reported similar results.[16–19] These results may be explained by the fact that men travel more often and are more likely to be bitten by dogs in unfamiliar areas.

When analyzing the month-wise distribution of dog bites, a higher prevalence was observed during May

and December in Tamil Nadu. The findings were consistent during the years 2022 and 2023. Similar findings showing two peaks in a year were observed in studies conducted in the USA, Canada, Uganda, and India.[14,17,20,21] In Western countries, the first peak occurs in March or April, and the second peak occurs in October or November. These findings could correlate with the proestrus cycle in dogs, which shows behavioral changes in all dogs.

Post dog bites, the victims seek health care facilities for first aid and post-exposure prophylaxis (PEP) with Tetanus toxoid and Anti-rabies vaccine. In certain patients, Rabies immunoglobulin is administered. The mode of health care provided was OPD care among most patients. Similarly, other studies conducted in India at Delhi, Tamil Nadu, and Kerala identified a similar kind of care provided.[3,9,19,,22] This indicated that dog bites are not fatal and can be managed in OPD facilities.

The PEP is necessary to prevent rabies. It is provided in all government health facilities on a 24-hour basis. Similarly, private institutions offer PEP when patients seek care in private institutions. According to our data, most dog bite cases sought PEP at a government health facility. Studies in Western nations have not produced much evidence-based literature on this. This indicates the effectiveness of government healthcare facilities and the trust within the community in India. This variability of higher reporting from Government institutions could also be due to the quality of reporting by Government institutions.

Primary healthcare facilities saw more PEP patients among government institutions than secondary and tertiary care facilities. This demonstrates the community's primary healthcare organizations' dependability and accessibility in delivering primary care, a crucial aspect of health.

The estimated burden on the community and the healthcare system including the public health system and animal husbandry due to dogs and dog bites is estimated to be Rupees 94 crores and 107 crores. These estimates could also increase over the years due to the increasing dog population. The estimates of animal husbandry is a non-recurring as it's a one time procedure. If not covered, the expenditure on the public health system for post-exposure prophylaxis will increase over the years hampering the entire system.

CONCLUSION

The number of people requirung PEP and the incidence of dog bites in Tamil Nadu are rising. With an increase in the requirement of PEP, the budgeting for procurement of PEP is also an increasing trend, leading to

a financial burden to the patients and the healthcare system. Therefore, it is imperative to implement a comprehensive plan to limit the number of stray dogs and use animal birth control methods to minimize dog bites. Similarly, the probability of rabies infection is high with an increase in dog bite cases. To prevent rabies infection, outreach to vaccination services for strayed and pet dogs and improving the knowledge in the community to seek healthcare providers for administration of PEP following dog bites is mandatory. It is high time that policymakers focus on preventive measures and increase budgeting for activities like animal birth control and promoting dog vaccination drives to prevent any untoward event in the upcoming years.

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DESCRIPTIVE ANALYSIS OF MUMPS CASES IN TAMIL NADU, JANUARY – MAY 2024 (BASED ON IHIP DATA)

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Abstract

INTRODUCTION : Mumps, a viral infection affecting children, leads to parotid gland swelling and is moderately to highly contagious. Complications include aseptic meningitis, encephalitis, orchitis, oophoritis, deafness, and pancreatitis. This study examines mumps cases in Tamil Nadu from January to May 2024 using data from the Integrated Health Information Platform (IHIP), focusing on district incidence, rural-urban differences, and age-specific attack rates.

METHODS : This cross-sectional study utilized Integrated Disease Surveillance Programme data from January to May 2024. Analyzed variables included gender, age, urban/rural classification, district, onset date, and geographical coordinates. Statistical analyses were performed using Epi Info, Open Epi, and QGIS to assess mumps trends, incubation period distribution, district-wise attack rates, and rural-urban differences.

RESULTS : From January 1 to May 20, 2024, 1,726 mumps cases were reported in Tamil Nadu. Cases increased sharply from January, peaked in April, and declined significantly in May, with similar patterns in rural and urban areas. Children aged 0-6 years had the highest attack rate, being about 9 times more likely to contract mumps than older individuals (95% CI: 8.196-9.902, $p < 0.05$). Males showed a significantly higher risk of infection [OR 1.176 (95% CI: 1.069-1.292, $p < 0.05$)]. Attack rates varied significantly across districts, with higher rates in Chennai, Kanyakumari, Kallakurichi, Tiruchirappalli, and Perambalur.

CONCLUSION : The high attack rate among children aged 0-6 years highlights the need to address mumps-related complications in this age group. Uneven case distribution across districts indicates potential hotspots, necessitating targeted public health interventions. The higher incidence among young children and males underscores the need to address vaccination gaps and improve public health awareness to mitigate severe outcomes.

KEYWORDS : Mumps, Age-specific attack rates, Rural and urban populations, District-wise analysis

INTRODUCTION

Mumps is a common viral infection in children, characterized primarily by swelling of the parotid gland (Parotitis). The mumps virus, which causes mumps infection, is an enveloped RNA virus classified under the genus Rubulavirus in the Paramyxoviridae family. Under electron microscopy, the virion appears as a particle with a shape that can be spherical or pleomorphic and has a diameter of approximately 200 nm . Virion membrane fusion appears to be linked to neurovirulence. The lipid membrane makes the virus vulnerable to ether and alcohol-based disinfectants. The virus remains stable at 4°C for several days. Complications of mumps include aseptic meningitis, encephalitis, orchitis in adult men, oophoritis in adult women, deafness, and pancreatitis.

Mumps is a moderately to highly contagious infection that is restricted to human beings. Transmission of the virus is by direct contact, droplet spread, or contaminated fomites. The incubation period is about 15 to 24 days (median, 19 days) Infected patients become most contagious 1 to 2 days before onset of clinical symptoms and continue so for several days afterwards. Mumps virus can, however, be isolated from saliva as early as 7 days before and until 9 days after onset of clinical symptoms.

Mumps is acquired through inoculation and replication of the virus in the nasal or upper-respiratory-tract mucosa. Infection can remain localised to the respiratory tract. Transient plasma viraemia is probably frequent, occurs late in the incubation period, and leads to viral spread into organs. Infected mononuclear cells can also contribute to systemic viral spread. The parotids are the most commonly affected organs, but parotitis is not a primary or necessary step for mumps infection. The central nervous system (CNS), urinary tract, and genital organs can also be affected. Infection of the kidneys leads to viruria, which is present in most patients and lasts for 10–14 days.

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This study aims to describe mumps cases reported across Tamil Nadu using data from the Integrated Health Information Platform (IHIP). The study will focus on the incidence of mumps in various districts, differences between rural and urban populations, and the age-specific attack rates.

METHODOLOGY

This is a cross-sectional study utilizes data collected from the Integrated Disease Surveillance Programme under Integrated Health Information portal (IHIP) covering the period from January 2024 to 20th May 2024. The data include reported provisional mumps cases from various districts in Tamil Nadu. The following variables from IHIP such as gender, age, urban local body, district, date of onset, longitude, latitude was used to analyze in this study. Official permission to conduct this study was obtained from Director of Public Health and Preventive Medicine (DPH &PM), Tamil Nadu. Based on the line listing data of mumps infections during the study period, analysis was carried out by Epi info software (version 7.2.5), Open epi along with QGIS software to determine trends in mumps cases, distribution by incubation period, district-wise attack rates, and differences between rural and urban populations and statistical analysis were performed to identify significant associations.

RESULTS

Trends in Mumps Cases:

From January to 20th May 2024, a total of 1726 mumps cases were reported in Tamil Nadu. The total number of mumps cases shows a sharp increase from January, peaking in April, followed by a significant decline in May. Both rural and urban areas follow a similar pattern, with cases rising from January to April and then decreasing in May. (Figure 1)
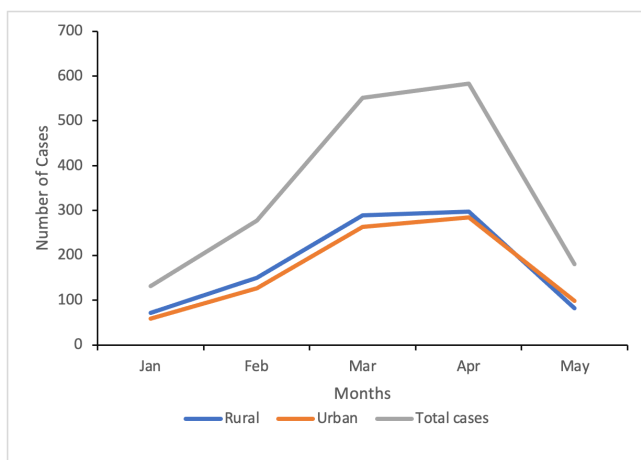
Figure 1: Trend of Mumps cases in rural and urban population in Tamil Nadu (Jan 2024 – Feb 2024) (N=1726)

Distribution by date of onset infection:

The Histogram (Figure 2) shows the distribution of mumps cases by the incubation period in Tamil Nadu from January 2024 to May 2024. There is a noticeable increase in the number of mumps cases from January and February 2024. The peak of the outbreak appears to be around mid-March 2024, with the highest number of cases reported on or around 18-03-2024. After the peak, there is a gradual decline in the number of cases through April and into May 2024. The highest bar, representing the peak, is approximately 120 cases. After the peak, the number of cases mostly ranges between 40 to 80 cases until the decline becomes more pronounced in May.
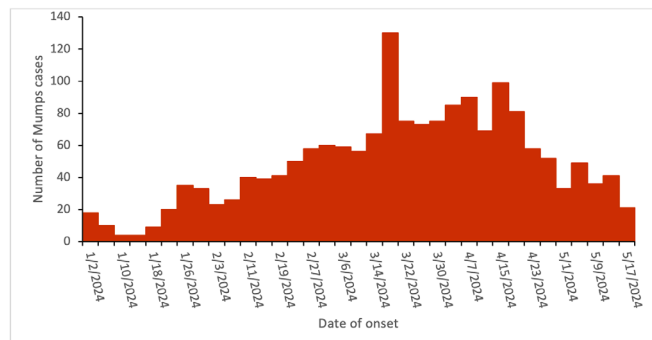
Figure 2: Distribution of Mumps cases by incubation period in Tamil Nadu (Jan 2024 – May 2024) (N = 1796)

District-Wise Attack Rates:

The attack rate, calculated in proportion to the population, varied significantly across districts as shown in Figures 3 and 4. Some districts, such as Chennai, Kanyakumari, Kallakurichi, Tiruchirappalli, and Perambalur, exhibited higher rates compared to others. In contrast, districts like Tirunelveli, Namakkal, Mayiladuthurai, Dindigul, Erode, and Thiruvarur showed lower attack rates. Notably, Dharmapuri and Nagapattinam did not report any mumps cases during the study period. This variation underscores the uneven distribution of mumps cases and identifies potential hotspots for outbreaks.
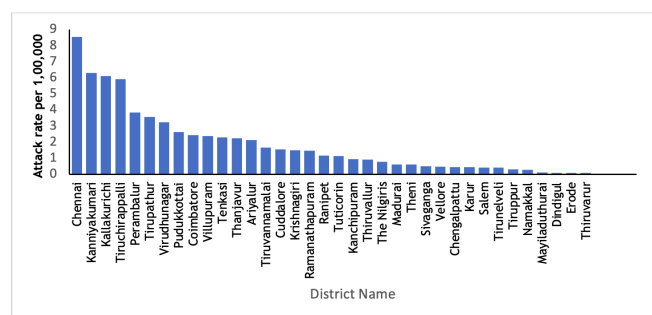
Figure 3: District wise Attack rate of Mumps cases in Tamil Nadu (Jan 2024 – May 2024) (N = 1726)
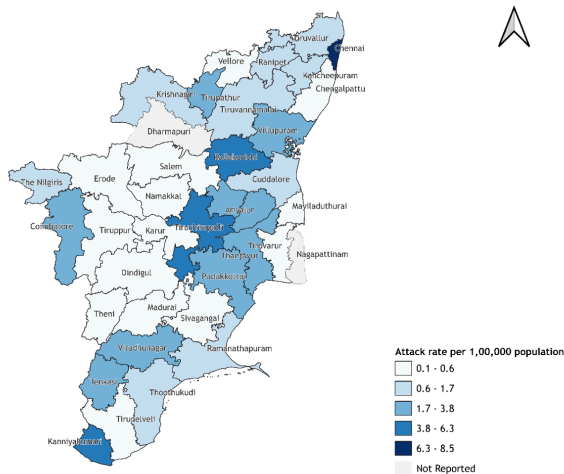
Figure 5: Spot map of Mumps cases reported in Tamil Nadu from Jan 2024 May 2024 (N = 1726)

The spot map (Figure 5) shows the distribution of mumps cases reported in Tamil Nadu from January to May 2024. Mumps cases are spread throughout the state of Tamil Nadu, affecting multiple districts. The red dots represent individual mumps cases. There are notable concentrations of cases in several districts, indicating potential clusters or outbreaks. Northern Tamil clusters are seen in the northern districts including Chennai, Kanchipuram, Tiruvallur, and Chengalpattu. Central Tamil Nadu Districts such as Vellore, Tiruvannamalai, and Villupuram also show a high number of cases and in southern Tamil Nadu Madurai and its surrounding areas such as Theni and Virudhunagar have visible clusters of mumps cases. This could be due to higher population density and increased person-to-person contact.

Age and Gender Specific Attack Rates:

The age group (0 – 6 years) shows the highest proportion of mumps cases and the attack rate was highest among children aged 0-6 years, followed by those aged 7-18 years. The odds ratio (OR) for mumps infection in children aged 0-6 years compared to older individuals in Tamil Nadu is 9.009. This means that children in this age group have about 9 times higher odds of contracting mumps than older individuals. The result is statistically significant, with a 95% confidence interval (CI) ranging from 8.196 to 9.902 and a p-value less than 0.05. The calculated Odd Ratio of 1.176 for males was statistically significant (95% CI: 1.069, 1.292, $p < 0.05$), suggesting a reliable association between being male and an increased risk of mumps infection. This association was statistically significant, suggesting that gender plays a role in susceptibility to mumps.
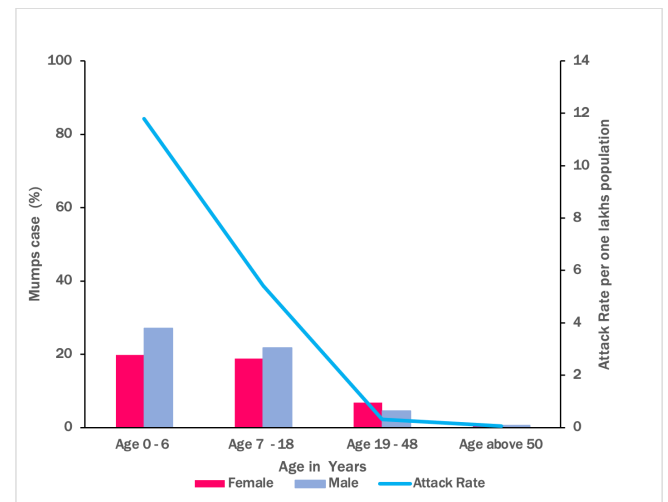
Figure 6: Gender and Age Group Distribution of Mumps Cases in Tamil Nadu (January - May 2024, N = 1726)

DISCUSSION

The high attack rate among children aged 0-6 years underscores the urgent need to address the risks of complications associated with mumps for this age group. Young children are particularly vulnerable to severe outcomes from mumps, including meningitis, encephalitis, orchitis (inflammation of the testicles), oophoritis (inflammation of the ovaries), and pancreatitis. The absence of immunization exacerbates these risks, leading to higher transmission rates and more severe health outcomes.

For children aged 7-18 years, while the attack rate is relatively lower compared to the 0-6 age group, they are still at significant risk for complications. Adolescents are particularly susceptible to orchitis, which can lead to sterility in post-pubertal males. Additionally, mumps in this age

group can result in hearing loss, which may have a lasting impact on educational and social development. A study conducted in Uttar Pradesh, India, by Kumar and Raj found a high incidence of mumps among children aged 0-6 years, mirroring the high attack rate observed in Tamil Nadu. This study also highlighted the risk of severe complications in this age group due to lack of immunization and indicated that males had a higher incidence of mumps than females, consistent with the gender-specific findings in Tamil Nadu, where males showed a higher odds ratio for contracting mumps.

Vaccination plays a crucial role in the control of mumps, particularly for the age groups 0-6 and 7-18 years. The Measles-Rubella (MR) vaccine, which is available in the Universal Immunization Programme (UIP) in India, provides partial protection.

However, the absence of the Mumps component in the UIP leaves a significant gap in the prevention strategy. Including the Mumps vaccine in the UIP could be highly beneficial, as evidenced by studies demonstrating the effectiveness of the MMR (Measles-Mumps-Rubella) vaccine in reducing mumps incidence and associated complications by Cohen et al., 2007 and by Dayan & Rubin, 2008). The MMR vaccine has been shown to significantly decrease the rate of mumps-related complications, such as orchitis, meningitis, and pancreatitis, thereby reducing the burden on healthcare systems and improving quality of life.

The rate of complications due to mumps is notably high, particularly among unimmunized populations. For instance, studies have shown that mumps can lead to complications in 10-20% of cases, with meningitis occurring in about 1-10% of mumps cases, and encephalitis occurring in less than 1% but with potentially severe consequences in the study by Hviid et al., 2008.

Orchitis affects approximately 15-30% of post-pubertal males with mumps, and it can lead to sterility in a small percentage of cases in the study done by Bitsko et al., 2016. Pancreatitis, although rarer, can also occur and lead to significant morbidity.

Timely treatment of mumps complications is essential to mitigate long-term health impacts. Ensuring prompt medical intervention, especially for severe outcomes such as encephalitis and orchitis, is crucial. Supportive care, including pain management and hydration, is often necessary, along with monitoring for secondary infections or complications as stated in the study by Plotkin, 2018. Public health efforts should focus on increasing immunization coverage, educating the public about the benefits of vaccination, and implementing strategies to ensure timely medical care for affected individuals.

CONCLUSION

This cross-sectional study of mumps cases in Tamil Nadu demonstrates the significant impact of mumps on public health, particularly in the absence of immunization. The data indicate a pressing need for targeted efforts to mitigate the risks of complications associated with mumps, especially among young children. Conducting longitudinal studies to monitor the long-term effects of mumps is deemed necessary. Evaluating the effectiveness of health education interventions in increasing awareness can reduce the burden of mumps-related complications and improve overall community health, particularly among the most vulnerable age groups.

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ORIGINAL ARTICLE - PUBLIC HEALTH

ANALYSIS OF COVID - 19 MORTALITY, TAMIL NADU, INDIA 2020 - 2024

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Abstract

INTRODUCTION : Globally, around 760 million cases and 6.9 million deaths were recorded since 2019. Currently, COVID-19 has been extensively studied globally, and the available studies indicate diversity in information about COVID-19 across regions and countries, highlighting the need for localized studies.

OBJECTIVE : The objective of this study is to understand the demographic and clinical characteristics of those who died due to COVID-19 and estimate the time intervals between the onset of symptoms, admission, and death.

METHODOLOGY : We obtained COVID-19 data for 38086 deaths from the epidemic section of the Directorate of Public Health and Preventive Medicine, Tamil Nadu, a southern Indian state from 25th March 2020 to 4th January 2024. Categorical variables were summarized as frequencies and percentages, while continuous variables were presented as mean, standard deviation (SD), median, and interquartile range (IQR) as appropriate. Proportions for categorical variables were analyzed using the chi-squared test. The analyses were performed using SPSS version 25.0.

RESULTS : The mean age of the deceased was 62.9 years (SD: 13.7 years), Almost two-thirds, 66.7%, of the deceased were males. 24% of deceased were from Chennai district. The crude death rate was 10.0/100,000 population; the age-specific death rate was highest (64.89/ 100,000 population) in the age group 75 years and above. 79.4 % reported with one or more comorbidities with most common being Diabetes(52.3%), hypertension(40.8%) & Coronary Artery disease. The comorbidities are higher (92.7%) in age group and 75 years and above and (63.9%) is noted in 0-14 years age group. Breathlessness (77.5), fever (75.6) and cough(68.4%) were the most common symptoms and it was found higher in age group 15-44 years. There is no difference in median time interval between hospital admission and death among age group and gender except the place of admission where the private institutions was higher when compared to government institutions. The time interval between getting lab tested covid-19 positive and death was shorter among age group 0-14 years and higher in private institutions

CONCLUSION : The Covid-19 death rate is highest among elderly age group, male gender and people living in districts with higher urban coverage. The comorbidities are higher in age group 75 years and above. The time interval between admission and death was higher in private institutions. The time interval between getting lab tested covid-19 positive and death was shorter among age group 0-14 years and higher in private institutions

KEYWORDS : COVID-19 in India Age and sex-specific death rate Comorbidities of COVID-19 Time interval between infection and death.

INTRODUCTION

COVID-19, caused by the SARS-CoV-2 coronavirus, typically spreads through close contact between individuals. The disease became a global health threat due to its rapid spread across countries. Globally, approximately 760 million cases and 6.9 million deaths have been recorded since 2019.[1]

The initial cases were detected in Hubei Province, China, in December 2019[2], with the first death reported in January 2020. The World Health Organization (WHO) declared it a pandemic on March 11, 2020.[3] In India, the first COVID-19 case was reported in January 2020 in Kerala (4), with the first death occurring in March 2020 in Karnataka. In Tamil Nadu, a southern state in India, the first case was reported in March 2020, with the first death also occurring that month. As of March 5, 2024, Tamil Nadu has recorded a significant number of 3,611,330 COVID-19 positive cases and 38,086 deaths.[5] The virus exhibits varying degrees of clinical manifestations across different countries.[6] The number of cases and deaths recorded in the districts of Tamil Nadu varies.[5] Given the extensive global studies on COVID-19, there is a clear diversity of information across regions and countries, underscoring the need for localized studies.

OBJECTIVE

The objective of this study is to understand the demographic and clinical characteristics of individuals who died due to COVID-19 and to estimate the time intervals between the onset of symptoms, hospital admission, and death.

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METHODOLOGY

We obtained COVID-19 data from the epidemic section of the Directorate of Public Health and Preventive Medicine, Tamil Nadu, a southern Indian state. The data included variables such as case ID, district, address, age, gender, name of hospital, type of admitting hospital, presence of comorbidities, presenting symptoms, date of hospital admission, and date of death. The data was collected from the date of the first COVID-19 death (25th March 2020) to the last COVID-19 death (4th January 2024) reported in Tamil Nadu, totalling 38,086 deaths. All deaths were included for analysis. Cases with details of comorbidities or symptoms were included for the respective analyses. Time intervals between becoming positive, hospital admission, and death were calculated for cases where data was available. Categorical variables were summarized as frequencies and percentages, while continuous variables were presented as mean, standard deviation (SD), median, and interquartile range (IQR), as appropriate. Proportions for categorical variables were analyzed using the chi-squared test. The analyses were performed using SPSS version 25.0.

RESULTS

Socio-demographic characteristics and age- and sex-specific mortality

The mean age of the deceased was 62.9 years (SD: 13.7 years), with no significant difference between males (63.3 years; SD: 13.8 years) and females (62.1 years; SD: 13.5 years). The age group 60 to 74 years accounted for the highest percentage of deaths, nearly 42.9% (16,338). Almost two-thirds, 66.7% (25,385), of the deceased were males. Approximately one-fourth of the deceased (24%) were from Chennai district. Around 61.6% (23,445) of deaths were recorded in government institutions, 38.1% (14,503) in private institutions, and the remaining 0.4% (138) at home.

The crude death rate was 10.0 per 100,000 population; the age-specific death rate increased with age, reaching the highest (64.89 per 100,000 population) in the age group 75 years and above and the lowest (0.05 per 100,000 population) in the age group 0 to 14 years. The death rate was higher among men (13.31 per 100,000 population) compared to women (6.64 per 100,000 population). Kancheepuram district recorded the highest death rate of 27.80 per 100,000 population. All districts except seven (Kancheepuram, Chennai, Chengalpattu, Vellore, Thiruvallur, Coimbatore, and Kanniyakumari) recorded a death rate less than 10.00 per 100,000 population (Table 1).

Table 1: Age, gender, hospital and geographic specific death rate Covid-19, Tamil Nadu 2020- 2024

Variables	Description	Number of Deaths (n =38086)							Deaths per 100,000 population
		2020	2021	2022	2023	2024(till4th Jan)	Total	%	
Age	0 to 14 years	23	11	2			36	0.1	0.05
	15 to 44 years	897	2797	43	5	1	3743	9.8	2.07
	45 to 59 years	3095	6882	176	8		10161	26.7	13.96
	60 - 74 years	5437	10387	503	10	1	16338	42.9	40.55
	75 years and above	2697	4560	539	12		7808	20.5	64.89
Gender	Female	3323	8983	383	12		12701	33.3	6.64
	Male	8826	15654	880	23	2	25385	66.7	13.31
Place of Death	Government Institution	7908	14884	639	13	1	23445	61.6	-
	Private Institution	4239	9623	618	22	1	14503	38.1	-
	Home Death	2	130	6			138	0.4	-
Geography	Chennai	4100	4615	422	6	1	9144	24.0	25.32
	Coimbatore	646	1860	101	3	1	2611	6.9	14.27
	Chengalpattu	704	1751	108	1		2564	6.7	21.24
	Thiruvallur	672	1184	79	4		1939	5.1	15.48
	Salem	459	1269	35	2		1765	4.6	9.57
	Kancheepuram	422	874	40	2		1338	3.5	27.80
	Vellore	346	935	20	3		1304	3.4	15.80
	Madurai	460	744	50			1254	3.3	7.80
	Trichy	182	930	59	2		1173	3.1	8.14
	Kanyakumari	257	806	24			1087	2.9	10.99
	Thanjavur	237	790	34			1061	2.8	8.34
	Tiruppur	219	803	25	1		1048	2.8	7.97
	Other districts (26)	3441	8076	266	11		11794	31.0	5.75
	Other state/Country	4					4	0.0	-
Total		12149	24637	1263	35	2	38086	100.0	10.00

Pre-existing comorbidities in deceased Covid-19 patients Tamil Nadu 2020- 2024

Among the 38,028 cases that reported the presence or absence of comorbidities, 79.4% (30,199) reported having one or more comorbidities. Diabetes was the most common comorbidity, associated with 52.3% of the deceased. Hypertension, coronary artery disease (CAD), chronic kidney disease (CKD), and hypothyroidism were present in 40.8%, 11.4%, 6.9%, and 3.1% of the deceased, respectively. The coexistence of diabetes and hypertension was found in 28.7% of the individuals, the coexistence of diabetes and CKD in 4.6%, the coexistence of diabetes and hypothyroidism in 1.9%, and the coexistence of diabetes, hypertension, and CAD in 5.9%.

All major comorbidities—diabetes, hypertension, CAD, and CKD—were significantly higher among males compared to females, except for hypothyroidism. The presence of comorbidities among those who died due to COVID-19 was significantly higher in the older age group (75 years and above, 92.7%) and remarkably higher in the younger age group (0-14 years, 63.9%). The percentage and number of deaths with comorbidities increased significantly with age among those who died due to COVID-19.

Deaths in private institutions had a higher percentage (83.8%) compared to government institutions (76.7%) due to comorbidities. Deaths associated with major comorbidities like diabetes, hypertension, and CAD were higher and statistically significant in private institutions compared to government institutions. The coexistence of diabetes and hypertension, as well as the coexistence of diabetes, hypertension, and CAD, were also higher and significant in private institutions. (Table 2)

Table 2 : Age, gender and hospital specific comorbidities in deceased Covid-19 patients, Tamil Nadu 2020- 2024

Comorbidities	Gender			Age Group						Place of death				Total (n=38028) %(n)
	Male (n=25341) %(n)	Female (n=12687) %(n)	p value	0-14 years (n=36) %(n)	15-44 years (n=3742) %(n)	45-59 years (n=10156) %(n)	60-74 years (n=16309) %(n)	75 years &above (n=7785) %(n)	p value	Government Institution (n=23391) %(n)	Private Institution (n=14499) %(n)	Home Death (n=138) %(n)	p value	
Presence of comorbidity*	78.3 (19853)	81.5 (10346)	<0.01	63.9 (23)	47.3 (1770)	67.8 (6887)	87.7 (14299)	92.7 (7220)	<0.01	76.7 (17934)	83.8 (12152)	81.9 (113)	<0.01	79.4 (30199)
One comorbidity	38.5 (9754)	40.0 (5070)		47.2 (17)	30.1 (1126)	34.5 (3505)	42.2 (6877)	42.4 (3299)		40.3 (9435)	36.9 (5349)	29.0 (40)		39.0 (14824)
Two comorbidity	25.2 (6398)	28.1 (3570)	<0.01	13.9 (5)	12.6 (472)	23.0 (2333)	29.4 (4795)	30.4 (2363)	<0.01	24.5 (5723)	28.9 (4195)	36.2 (50)	<0.01	26.2 (9968)
More than two comorbidities	14.6 (3691)	13.4 (1704)		2.8 (1)	4.6 (171)	10.3 (1045)	16.1 (2625)	19.9 (1553)		11.9 (2773)	18.0 (2607)	10.9 (15)		14.2 (5395)
Diabetes Mellitus	51.7 (13096)	53.5 (6782)	<0.01	2.8 (1)	27.2 (1019)	50.1 (5091)	58.5 (9546)	54.2 (4221)	<0.01	49.6 (11607)	56.5 (8192)	57.2 (79)	<0.01	52.3 (19878)
Hypertension	39.4 (9972)	43.8 (5552)	<0.01	0(0)	14.2 (533)	33.7 (3427)	46.1 (7515)	52.0 (4049)	<0.01	37.0 (8656)	46.9 (6795)	52.9 (73)	<0.01	40.8 (15524)
Coronary Artery Disease	13.1 (3310)	8.2 (1044)	<0.01	2.8 (1)	2.0 (73)	6.8 (689)	13.1 (2143)	18.6 (1448)	<0.01	9.7 (2279)	14.3 (2072)	2.2 (3)	<0.01	11.4 (4354)
Chronic Kidney Disease	7.4 (1881)	5.8 (742)	<0.01	5.6 (2)	5.2 (195)	6.7 (684)	7.2 (1175)	7.3 (567)	<0.01	6.7 (1557)	7.3 (1064)	1.4 (2)	<0.01	6.9 (2623)
Senility	7.6 (1933)	7.2 (916)	0.16	0(0)	0(0)	0(0)	10.5 (1712)	14.6 (1137)	<0.01	8.1 (1893)	6.6 (952)	2.9 (4)	<0.01	7.5 (2849)
Hypothyroidism	1.6 (416)	5.9 (744)	<0.01	0(0)	3.2 (120)	2.9 (297)	3.0 (497)	3.2 (246)	0.69	2.2 (514)	4.4 (645)	0.7 (1)	<0.01	3.1 (1160)
Cerebrovascular Accident	1.9 (489)	1.3 (162)	<0.01	0(0)	0.6 (23)	1.1 (110)	2.0 (326)	2.5 (192)	<0.01	1.8 (432)	1.5 (218)	0.7 (1)	0.03	1.7 (651)
Bronchial Asthma	1.4 (356)	2.2 (282)	<0.01	0(0)	1.6 (60)	1.5 (148)	1.5 (250)	2.3 (180)	<0.01	1.4 (338)	2.1 (298)	1.4 (2)	<0.01	1.7 (638)
Chronic Obstructive Pulmonary Disease	1.6 (416)	1.2 (152)	<0.01	0(0)	0.3 (11)	0.7 (72)	1.7 (281)	2.6 (204)	<0.01	1.3 (315)	1.7 (252)	0.7 (1)	0.01	1.5 (568)
Obesity	1.1 (278)	2.0 (257)	<0.01	0(0)	3.7 (137)	1.9 (190)	0.9 (154)	0.7 (54)	<0.01	1.3 (301)	1.6 (234)	0(0)	0.01	1.4 (535)
Cancer	0.8 (207)	1.0 (129)	0.05	8.3 (3)	1.1 (40)	0.9 (87)	0.9 (140)	0.8 (66)	<0.01	0.9 (203)	0.9 (132)	0.7 (1)		0.9 (336)
Tuberculosis	0.7 (173)	0.4 (48)	<0.01	2.8 (1)	0.9 (35)	0.6 (60)	0.5 (85)	0.5 (40)	0.01	0.7 (174)	0.3 (47)	0(0)	<0.01	0.6 (221)
Diabetes Mellitus & Hypertension	27.8 (7033)	30.7 (3900)	<0.01	0(0)	7.0 (263)	23.6 (2401)	33.8 (5513)	35.4 (2756)	<0.01	25.6 (5992)	33.7 (4886)	39.9 (55)	<0.01	28.7 (10933)
Diabetes Mellitus & Chronic Kidney Disease	4.9 (1247)	3.9 (495)	<0.01	0(0)	1.7 (63)	4.3 (437)	5.3 (863)	4.9 (379)	<0.01	4.2 (985)	5.2 (756)	0.7 (1)	<0.01	4.6 (1742)
Diabetes Mellitus & Hypothyroidism	1.1 (273)	3.5 (442)	<0.01	0(0)	1.2 (45)	1.7 (168)	2.1 (346)	2.0 (156)	<0.01	1.3 (302)	2.8 (412)	0.7 (1)	<0.01	1.9 (715)
Diabetes Mellitus & Obesity	0.4 (110)	1.0 (124)	<0.01	0(0)	1.3 (47)	0.8 (77)	0.5 (81)	0.4 (29)	<0.01	0.5 (122)	0.8 (112)	0(0)	0.01	0.6 (234)
Diabetes Mellitus & Hypertension & Coronary Artery Disease	6.5 (1640)	4.7 (592)	<0.01	0(0)	0.7 (26)	3.3 (340)	6.9 (1123)	9.5 (743)	<0.01	4.7 (1096)	7.8 (1134)	1.4 (2)	<0.01	5.9 (2232)

* 12 records had comorbidities with the comorbodity not being mentioned

Presented symptoms in deceased Covid-19 patients:

Among 31,270 deaths where the presence or absence of presenting symptoms of COVID-19 patients were reported, breathing difficulty was the most common symptom, present in 77.5% of the patients (77.3% of men, 77.7% of women).

Fever was reported in 75.6% (75.8% of men, 75.0% of women), and 68.4% had a cough (68.8% of men, 67.5% of women).

Additionally, 44.7% had fever, cough, and breathing difficulty together (45.0% of men, 44.2% of women), with statistically significant differences for fever being higher in men and breathing difficulty being higher in women.

Generalized weakness/myalgia/tiredness, diarrhoea, and sore throat were reported by 4.3%, 1.7%, and 1.0% of the patients, respectively, with women reporting significantly higher rates of diarrhoea than men (p < 0.001). Fever, cough, and breathing difficulty were significantly higher among the age group 15-44 years (p < 0.001). Diarrhoea and generalized weakness/myalgia/tiredness were significantly higher among the elderly age group 75 years and above (p < 0.001 and p = 0.04, respectively).

Fever, cough, diarrhoea, and generalized weakness/myalgia/tiredness were reported to be significantly higher among those who died in private institutions (p < 0.001), while breathing difficulty and the combination of fever, cough, and breathing difficulty were reported to be significantly higher among those who died in government institutions (p < 0.001). (Table-3).

Table 4: Age, gender and hospital specific presenting symptoms in deceased Covid-19 patients, Tamil Nadu 2020- 2024

Presenting Symptom	Gender			Age Group						Place of death				Total (n=31270) %(n)
	Male (n=20647) %(n)	Female (n=10623) %(n)	p value	0-14 years (n=14) %(n)	15-44 years (n=3067) %(n)	45-59 years (n=8275) %(n)	60-74 years (n=13423) %(n)	75 years &above (n=6491) %(n)	p value	Government Institution (n=17501) %(n)	Private Institution (n=13758) %(n)	Home Death (n=11) %(n)	p value	
Fever	75.8 (15658)	75.0 (7972)	0.04	57.1 (8)	79.0 (2424)	76.6 (6335)	75.3 (10108)	73.3 (4755)	<0.01	73.3 (12829)	78.4 (10792)	81.8 (9)	< 0.001	75.6 (23630)
Cough	68.8 (14200)	67.5 (7175)	0.3	35.7 (5)	73.3 (2248)	70.4 (5824)	68.2 (9150)	63.9 (4148)	<0.01	68.3 (11957)	68.4 (9410)	72.7 (8)	< 0.001	68.4 (21375)
Breathing difficulty	77.3 (15968)	77.7 (8259)	<0.01	35.7 (5)	81.0 (2483)	79.9 (6610)	77.5 (10400)	72.9 (4729)	<0.01	83.5 (14615)	69.8 (9607)	45.5 (5)	< 0.001	77.5 (24227)
Diarrohea	1.5 (300)	2.1 (221)	<0.01	0 (0)	1.1 (33)	1.4 (116)	1.8 (240)	2.0 (132)	<0.01	1.3 (229)	2.1 (292)	0 (0)	< 0.001	1.7 (521)
Myalgia/weakness/ tiredness	4.3 (889)	4.4 (463)	0.47	0 (0)	4.0 (123)	4.0 (335)	4.3 (576)	4.9 (318)	0.04	3.6 (637)	5.2 (715)	0 (0)	< 0.001	4.3 (1352)
Sore throat	1.1 (217)	0.9 (100)	0.49	0 (0)	1.0 (32)	1.1 (89)	1.0 (137)	0.9 (59)	0.89	1.2 (207)	0.8 (110)	0 (0)	0.24	1.0 (317)
Fever, breathing difficulty and cough	45.0 (9281)	44.2 (4691)	0.48	7.1 (1)	51.8 (1590)	47.3 (3912)	44.2 (5927)	39.2 (2542)	<0.01	46.4 (8125)	42.5 (5844)	27.3 (3)	< 0.001	44.7 (13972)

Time intervals between lab testing covid-19 positive and death; admission and death in deceased Covid-19 patients, Tamil Nadu 2020- 2024:

The median time interval between testing COVID-19 positive and death was 5 days (IQR: 2, 9), with significant differences among age groups (p < 0.01). The shortest interval was observed in the 0-14 years age group (2 days, IQR: 1-7), and the longest interval was observed in private institutions (6 days, IQR: 3-10).

The median time interval between admission and death was 4 days (IQR: 2, 8), with significant differences among age groups (p < 0.01). The shortest interval was in the 0-14 years age group (1-5.8 days, IQR). There were also significant differences based on the place of death (p < 0.01), with the longest interval in private institutions (6 days, IQR: 3-10) compared to government institutions (4 days, IQR: 2-7) (Table-4).

Table 4: Age, gender and hospital specific time intervals

Variable	Description	Time interval between lab testing covid 19 positive and Death (n=38086)						Time interval between hospital admission and Death (n=37948)					
		N	Mean	Median	SD	IQR	P Value	N	Mean	Median	SD	IQR	P Value
Age group	0 - 14 years	36	4.3	2	4.8	1 -7		36	4.7	4	4.6	1-5.8	
	15 - 44 years	3743	6.2	5	5.6	2-9		3736	5.7	4	5.1	2-8	
	45 -69 years	10161	6	4	5.5	2- 9	<0.01	10146	5.6	4	5.1	2-8	<0.01
	60 -74 years	16338	5.9	5	5.3	2-9		16299	5.7	4	5	2-8	
	75 years and above	7808	5.6	4	4.9	2-8		7731	5.5	4	4.7	2-8	
Gender	Male	25385	5.9	5	5.3	2-9	0.06	25310	5.7	4	5	2-8	0.02
	Female	12701	5.7	4	5.2	2-8		12638	5.5	4	4.9	2-8	
Place of Death	Government Institution	23445	5.1	4	4.9	1-7		23445	4.8	4	4.4	2-7	
	Private Institution	14503	7.1	6	5.8	3-10	<0.01	14503	7.1	6	5.5	3-10	<0.01
	Home Death	138	3.8	3	4.1	0-6							
Total		38086	5.9	5	5.3	2-9		37948	5.7	4	5	2-8	

DISCUSSION

It is clearly established that COVID-19 exhibits demographic diversity across regions and countries. While many studies from other countries have analysed the characteristics of COVID-19 deaths, there has been no comprehensive study analysing the entire COVID-19 deaths from 2020 to 2024 in Tamil Nadu state. Our study described the demographic and clinical characteristics of deceased COVID-19 patients and estimated the time intervals between the date of lab testing positive to death and admission to death. This might help develop geographically specific public health interventions.

Our study indicated diversity in death rates among gender, age groups, and geography. The death rate increased with age, confirming existing evidence that age is one of the most significant risk factors. The increasing death rate with age may be due to the presence of more comorbidities and decreased immunity among the elderly. [7,8]

Our study reported that almost two-thirds of deaths (66.7%) were among males, which was almost double compared to females (Males - 13.31/100,000 population; Females - 6.64/100,000 population). This higher mortality pattern among males is consistent with another study from Italy (8). Genetics, epigenetics, and inborn errors of immunity may account for the disparity in mortality among men and women with COVID-19.[9]

Geographically, deaths were noted to be high in districts with higher urban coverage. A study showed that mortality was higher among those with comorbidities.[8,9] Comorbidities are major risk factors for COVID-19.[10]

A study noted that 75% of personnel with COVID-19 who were hospitalized had at least one comorbidity, with common comorbidities being hypertension, diabetes, cancer, neurodegenerative diseases, cardiovascular diseases, obesity, and kidney diseases.[11] Another study reported that 399 (25.1%) patients had one comorbidity, and 130 (8.2%) patients had two or more comorbidities.[12] In our study, the presence of comorbidities among the deceased was found to be 79.4%, with 39% having one comorbidity, 26.2%

having two comorbidities, and 14.2% having more than two comorbidities.

The percentage of comorbidities increased with age. Hypertension (16.9%), diabetes (8.2%), cardiovascular diseases (3.7%), and chronic kidney disease (1.3%) were the most common comorbidities in all COVID-19 patients.[12] Another study noted comorbidities such as cardiovascular or cerebrovascular diseases, diabetes, digestive system diseases, and malignant tumors.[13] In our study, the most common comorbidities noted were diabetes (52.3%), followed by hypertension (40.8%) and coronary artery diseases (11.4%). Other specific comorbidities noted were chronic kidney disease and hypothyroidism, especially among women. Significant comorbidity combinations included diabetes associated with hypertension, chronic kidney disease, obesity, and hypothyroidism.

Comorbidities in the younger age group were higher compared to the subsequent age group. The most common symptoms noted were fever, fatigue, and dry cough.[12,13,14,15]. A meta-analysis showed fever as the most common symptom, followed by dry cough and fatigue.[16] In our study, the most common symptoms noted were breathing difficulty (77.5%), fever (75.6%), and cough (68.4%), with these three symptoms altogether noted in 44.7% of patients who died due to COVID-19. These symptoms were found to be higher in the age group 15-44 years.

A study conducted on COVID-19 mortality cases from Tamil Nadu from March to April 2020 found the median time interval between hospital admission and death to be 4 days, with a significant difference between patients admitted in private and public hospitals.[17] In our study, the same median time interval between hospital admission and death was 4 days, with a significant difference; a higher difference of 6 days median time interval was noted among private institutions. In other countries, the median time interval was higher with a wide range of time intervals.[18-21]

The time interval between testing positive for COVID-19 and death had a median time interval of 5 days, with a significant difference between COVID-19 deaths occurring in government institutions and private institutions. The median time interval between testing positive and death was very short among the age group 0-14 years.

CONCLUSION

The COVID-19 death rate is highest among the elderly age group, male gender, and people living in districts with higher urban coverage. Comorbidities are seen in most patients, varying across age groups, with a higher prevalence in the elderly (75 years and above) and a notable percentage in the 0-14 years age group. Breathlessness, fever, and cough were the most common symptoms found in the 15-44 years age group. There was no significant difference in the median time interval between hospital admission and death across age groups and gender, except for the place of admission, where the interval was higher in private institutions compared to government institutions. The time interval between testing positive for COVID-19 and death was shorter among the 0-14 years age group and higher in private institutions.

LIMITATIONS

The data of presence or absence of comorbidities was not available for few records. Without complete data, the analysis might not fully represent the population and the missing information might systematically differ from the recorded data. The absence of data reduces the sample size, which can decrease the statistical power of the study. This makes it harder to detect significant differences or associations, especially in subgroup analyses.

CONFLICT OF INTEREST
None

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ORIGINAL ARTICLE - PUBLIC HEALTH

EPIDEMIOLOGICAL PROFILE OF LEPTOSPIROSIS IN TAMIL NADU, 2021-2024: AN ANALYSIS OF IDSP-IHIP PROGRAMME DATA

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Abstract

INTRODUCTION : Leptospirosis is a zoonotic disease of public health importance driven by climate and ecological factors. It is noted as a re-emerging disease by WHO, and the number of cases are increasing steadily. The present study was undertaken to understand the epidemiological profile and trend of leptospirosis, analyze the trends of leptospirosis cases between 2021 & 2024, and forecast the disease.

METHODOLOGY : The data of confirmed leptospirosis cases in Tamil Nadu were retrieved from the IDSP- IHIP portal and entered in MS- Excel. Statistical analysis was done using SPSS version 20.0. Descriptive statistics was used. For analysing the trend and to forecast the same, the time series analysis method was used.

RESULTS : The positivity rate of leptospirosis was 9.7% (95% CI: 9.5 to 9.9). The mean age of the leptospirosis cases was 35 years. Of the 7080 cases, females were 50.18%. The majority of cases were from Chennai (35.4%). The trend of leptospirosis depicts that the number of cases starts to increase June to December. This typically corresponds with the rainy season of Tamil Nadu. The predicted number of cases for January 2021 to March 2024 made by the model matched with original number reported in the IDSP- IHIP portal. On forecasting, the model showed a steady increase in the number of cases each year, still following the seasonal trend.

CONCLUSION : Leptospirosis shows a seasonal trend with more cases from June to December, and it correlates with the rainy and flooding season of the region.

KEYWORDS : Leptospirosis, zoonotic disease, trends, time series analysis, forecast

INTRODUCTION

Leptospirosis is a zoonotic disease with epidemic potential. It is caused by the bacterium Leptospira. The disease is endemic in countries with humid subtropical, tropical and temperate climates.[1] The prevalence of leptospirosis, as per WHO, ranges from 0.1 to 1 per 100,000 per year in temperate climates. It goes up to 10 or more per 100,000 annually in the humid tropics. During outbreaks and in high-risk groups, disease incidence may reach over 100 per 100,000.[2] India is known for outbreaks of leptospirosis and has been documented in India since 1931. The disease is endemic in Kerala, Tamil Nadu, Karnataka, Gujarat, Maharashtra and Andaman and Nicobar islands. It has also been reported from Andhra Pradesh, Goa, Orissa, West Bengal, Uttar Pradesh, Delhi, Puducherry, Dadar & Nagar Havelli, Daman & Diu.[3,4,5] In Tamil Nadu, leptospirosis cases have been reported from Chennai since 1980's.[3] All the districts in Tamil Nadu except Udhagamandalam and Thoothukudi are endemic for Leptospirosis.[6]

Leptospirosis has been reported as significant emerging and re-emerging disease by the World Health Organization (WHO). It widely spreads among humans and animals due to the rapid ecological changes such as rapid urbanization, poor sanitation, poor or improper waste management, poor surveillance program and control plan, and negligence of the disease.[4,7] They remain neglected even in the most endemic countries because of the lack of awareness, clinical suspicion, and absence of suitable diagnostic tools - effectively putting them in the category of Neglected Zoonotic Diseases (NZDs). Moreover, significant under-reporting and under-diagnosis of leptospirosis cases has been noticed.[8]

Human infections are rampant in tropical regions with high rainfall, where the human population gets exposed to water contaminated with the infected urine of the animals. Rodents are considered the major reservoir of infection. Leptospira are excreted in the urine of the infected animals. Hence, this illness commonly occurs during the monsoon months. The infection is usually transmitted when they pass through stagnant rainwater contaminated by the infected urine of animals. They can also enter the host through the abrasions of the skin on the feet or through intact mucous

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membranes of the eye, throat, and gut.[3,9]

The clinical spectrum of leptospirosis ranges widely from mild anicteric presentation to severe leptospirosis with multiple organ involvement. Fever, jaundice, vomiting, diarrhoea, intravascular disseminated coagulation, renal and hepatic insufficiency followed by renal and hepatic failure, myocarditis with cardiac arrhythmias, pulmonary hemorrhage with respiratory failure, and death are possible symptoms of leptospirosis. Because of its wide presentation, all cases of fever with myalgia and conjunctival suffusion in endemic areas should be suspected of leptospirosis.[3,4,9]

Leptospirosis follows a seasonal pattern in most countries. Meteorological factors like temperature, humidity, and rainfall play a vital role in its etiology.[2,10] An understanding of the seasonal trend of leptospirosis would help in knowing the disease burden in advance. This in turn, would help the public health administrators take appropriate actions to control and prevent future outbreaks. In this context, the present study was undertaken to describe the epidemiological profile, analyze the trends of leptospirosis cases between 2021 and 2024, and forecast the disease for the next three years.

METHODOLOGY

This retrospective study was done using the surveillance data of leptospirosis cases. The data was retrieved from the IDSP – IHIP (Integrated Disease Surveillance Programme- Integrated Health Information Platform) portal of Directorate of Public Health and Preventive Medicine, Tamil Nadu between April 2021 and March 2024. Prior permission was obtained from the Director of Public Health and Preventive Medicine (DPH & PM), Tamil Nadu, for the use of secondary surveillance data.

IDSP was started in the year 2004 to strengthen the disease surveillance in the country and also to improve the reporting of cases. Based on the recommendation of the 2015 Joint Monitoring Mission report to review and redesign the IDSP surveillance system, the IDSP-IHIP portal was launched, and it became functional on April 5th, 2021. Following that, the cases are reported in the IDSP- IHIP portal on a real time daily basis from the Government and private health institutions.[11]

Operational definitions:[12,13]

Probable case of leptospirosis (P form): A person having acute febrile illness with headache, myalgia and prostration associated with a history of exposure to infected animals or an environment contaminated with animal urine with one or more of the following: Calf muscle tenderness (or) Conjunctival suffusion (or) Anuria (or) oliguria (and/or) proteinuria (or) Jaundice (or) Haemorrhagic manifestations (or) Meningeal irritation (or) Nausea, Vomiting, Abdominal pain, Diarrhoea (and)

Laboratory confirmed case of leptospirosis (L form): A case compatible with the clinical description of leptospirosis with at least one of the following: High titre of IgM antibodies in ELISA (evaluated with locally determined cut-off) for single clinical sample (or) Four-fold or greater rise or persistent titre (in case of antibiotic given) in the MAT (total antibodies) between acute and convalescent-phase serum specimens run parallel (or) Seroconversion on ELISA in paired serology (demonstrating conversion of IgM to IgG antibodies).

[Isolation and Validated PCR can be done in patients who have not received antibiotic and in early stage of diseases (preferably less than 7 days].

Positivity rate: Number of positive results/ Total number of tests done x 100.

We got the line-listing of all laboratory-confirmed leptospirosis cases reported during the study period. The line list included the epidemiological and laboratory profiles of all the cases.

Statistical analysis:

The month- and year-wise data of leptospirosis cases was entered in MS Excel, and statistical analysis was performed using IBM SPSS Statistics, version 20. Data on a categorical scale are presented in numbers and percentages, and those on a continuous scale are presented in Mean ± SD.

For analysing the trend and to forecast the same, time series analysis with an expert modeller method was used. Trend analysis was done from January 2021 to March 2024 and forecasting was attempted from April 2024 to December 2027. The correctness of the model was verified using Ljung-Box statistics.

RESULTS :

Table 1: Age-wise distribution of leptospirosis cases in Tamil Nadu between 2021and 2024

Variable	Frequency (N= 7080)	Percentage (%)
Age category		
< 5 years	175	2.5
6 to 9 years	277	3.9
10 – 19 years	1147	16.2
20 to 40 years	2845	40.2
40 to 60 years	1831	25.9
>60 years	805	11.4
Gender		
Male	3525	49.78
Female	3553	50.18
Transgender	2	0.03

During the study period from April 2021 to March 2024, 7080 confirmed cases of leptospirosis were reported in the IDSP-IHIP portal. The Mean (± SD) age of the study cases was 35 years (± 18.7).

Table 1 represents the age and distribution of the leptospirosis cases. Majority of the cases belonged to the age group of 20 to 40 years (40.2%) followed by the age group of 40 to 60 years (25.9%).

Among the 7080 leptospirosis cases reported, the proportion of females (50.18%) was higher than that of males (49.78%), and the difference is statistically significant with p<0.05 by univariate analysis.

During the study period, 73329 samples suspected of leptospirosis were tested, and 7080 were confirmed of the disease.

Table 2: Positivity rate of leptospirosis between April 2021 and March 2024

Gender	Total samples tested	Samples positive	Positivity rate	95% CI
Male	34821	3525	10.1	9.8 to 10.4
Female	38485	3553	9.2	8.5 to 9.5
Transgender	23	2	9.1	1.1 to 29.1
Total	73329	7080	9.7	9.5 to 9.9

Table 2 shows the positivity rate of leptospirosis for males, females and transgender. The positivity rate of leptospirosis was estimated to be 9.7% (95% CI: 9.5 to 9.9).

The majority of the samples were confirmed by IgM ELISA (70.8%) followed by MAT serology (26.6%), rapid IgM test (2.3%) and culture (0.2%). Most reported cases (63.6%) required hospitalization; and others (36.4%) were treated in the 31 outpatient department.

The district-wise distribution of leptospirosis cases in Tamil Nadu shows that Chennai (35.4%) has the majority of cases followed by Thiruvallur (9.6%), Thiruvannamalai (5.5%), Thiruvarur (4.3%) and Kanniyakumari (3.9%). 1.9% of cases were migrants from Kerala, Andhra Pradesh, Karnataka, Maharashtra, West Bengal, Orissa, Uttar Pradesh, Nepal, Manipur, Jharkhand, etc. (Figure 1)

Total number of cases reported from January 2021 to March 2024 was 7293 (Cases from January 2021 to March 2021 was taken from the old version of IDSP).

The highest number of cases (2799) was reported in the year 2023 followed by 2022 (2643). On comparing the monthly data of leptospirosis cases from 2021 to 2023, it clearly shows that the number of cases starts to increase from June, and steadily increases till December and then gradually decreases. This trend is consistent every year. (Figure 2).
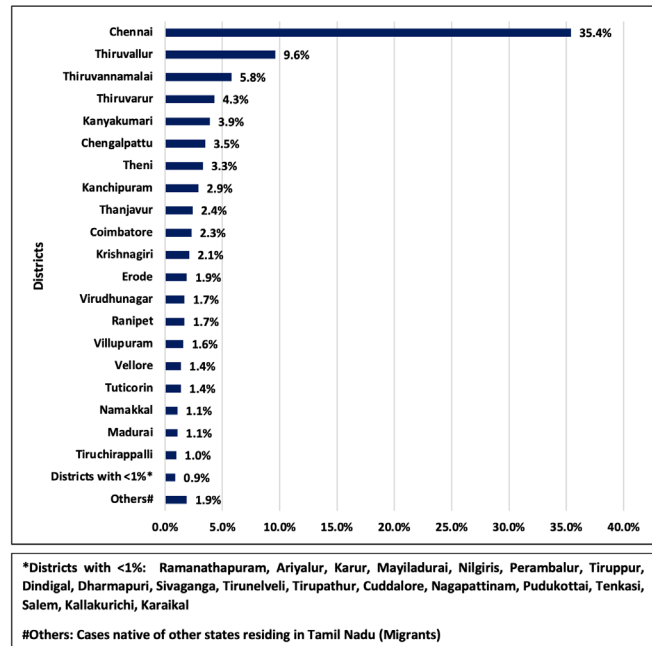

*Districts with <1%: Ramanathapuram, Ariyalur, Karur, Mayiladurai, Nilgiris, Perambalur, Tiruppur, Dindigal, Dharmapuri, Sivaganga, Tirunelveli, Tirupathur, Cuddalore, Nagapattinam, Pudukottai, Tenkasi, Salem, Kallakurichi, Karaikal

#Others: Cases native of other states residing in Tamil Nadu (Migrants)

Figure 1: District-wise distribution of leptospirosis cases in Tamil Nadu between 2021 and 2024 (N=7080)
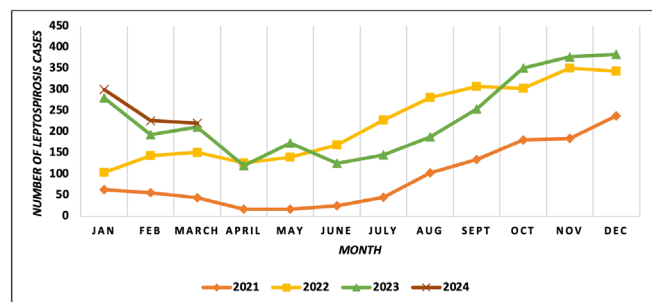

Figure 2: Trends of leptospirosis in Tamil Nadu between 2021 and 2024

The time series chart was created by SPSS using expert Modeller method with number of cases of leptospirosis month and year-wise. The model showed a showed seasonal periodic trend. The expert modeller in SPSS suggested a Winter's Additive model as the best fitting model for this time series data. Ljung- Box statistics test indicated that the model was correctly specified for the data [p = 0.187 (p>0.05)]. The expert modeller did not find any outliers in the model.

As per the figure 3, it was observed that the predicted number of cases for January 2021 to March 2024 made by the model matched with original number reported in Tamil Nadu as per IDSP- IHIP data. With this model fit, the number of cases that can be expected for the next three years was forecasted. The model showed a steady increase in the number of cases each year (2024 – 3474 cases; 2025 – 3699 cases, 2026 – 4986 cases, 2027 – 5785 cases) yet

following the seasonal trend. The graph shows the observed cases, forecasted cases with LCL (Lower Confidence Limit) and UCL (Upper Confidence Limit).
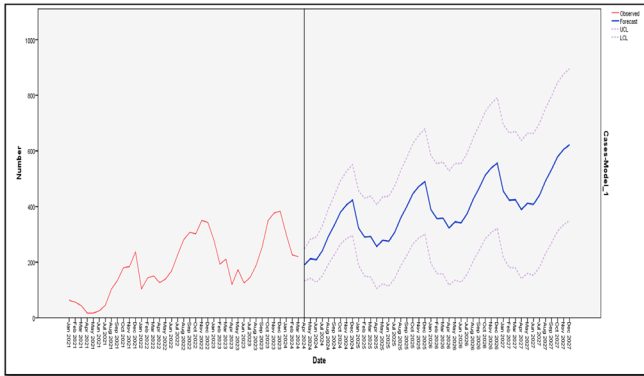

Figure 3 : Time series analysis chart from 2021 to 2023 and Forecast of leptospirosis cases from 2024 to 2027

DISCUSSION

Leptospirosis is a neglected zoonotic disease. It is reported to be an emerging and re-emerging disease due to rapid ecological changes. The change in the distribution and incidence of leptospirosis has occurred proportionately to the alterations in the eco-system; causing major epidemics in different regions.[4] To improve the surveillance of the disease, leptospirosis cases are reported in the IDSP – IHIP portal on daily real-time basis in India. Surveillance data was retrieved from the IDSP-IHIP portal to understand the trends of leptospirosis in the state of Tamil Nadu.

Out of the 73329 samples tested for leptospirosis, 7080 were confirmed of the disease. The majority of cases belonged to the age group of 20 to 60 years (66.1%). The mean age of the study cases was 35 years. This is in line with the studies done by Shukla S et al.[5] in Uttarpradesh, Arumugam G et al.14 in Chennai, Vidhya VR et al.1[15] in Kanniyakumari, Kalaivani V et al.16 in Thoothukudi, Sethi S et al.[17] in Northern India and Muthsethupathi MA et al.[18] in Chennai. These studies state that though all ages are susceptible, majority of leptospirosis cases belong to the age group between 20 and 40 years which represent the occupationally active group; and the males are more affected than the females. However, in this study, the proportion of females (50.18%) are higher than that of males (49.78%). This may be because, the increase in women getting involved in occupations (agriculture, animal husbandry, fisheries), involving outdoor work and recreation. Another reason may be, among the 73329 samples tested, the proportion of the females (38,485) tested are higher than the males (34,821).

In this study, the positivity rate of leptospirosis was estimated to be 9.7% (95% CI: 9.5 to 9.9). The estimation

of positivity rate for leptospirosis varies widely in different regions of the country. A meta-analysis showed, the positivity rate was found to be 9.47% between 2005 and 2023. Similarly, the positivity rate of leptospirosis over 10 years from 2011 to 2021 in Chengalpattu district, Tamil Nadu was found to be of 9.14%.[9] A study along coastal Thoothukudi had 10% positivity rate.16 A multi-centric study by ICMR task force estimated the positivity rate of leptospirosis in India to be 12.7% ranging between 3.27 to 28.2%.[19] In Tamil Nadu, Chennai showed a greater positivity rate ranging from 17.8% to 40.5%.[3,14]

In this study, the top five districts that showed higher prevalence in the study period are Chennai (35.4%), Thiruvallur (9.6%), Thiruvannamalai (5.5%), Thiruvarur (4.3%) and Kanniyakumari (3.9%). Chennai always has a higher prevalence than other parts of the state. Leptospirosis occurs in Chennai throughout the year.[14] Leptospirosis is rampant in areas with inadequate sanitation and hygiene associated with copious rainfall and flooding. Moreover, cities like Chennai have more slums that create an ideal environment for rodents, which are the primary carriers of the Leptospira. Dense population and insanitation favour the spread of the disease.[20-22]

In addition to this, coastal regions and agricultural districts of rice farming are noted to have a higher incidence of leptospirosis. Coastal regions experience hot humid climate that favours the growth of bacteria. Furthermore, the existence of water bodies that become infected with the urine of contaminated animals favours the disease spread. Moreover, fishing practices in these districts also play a significant role. Fishermen are probably exposed to the infected water and soil.[20-22]

In this study, the trend of leptospirosis clearly shows that the number of cases starts to increase from June. It steadily increases till December and then gradually decreases from January. This typically corresponds with the rainy season of Tamil Nadu. Tamil Nadu has three distinct periods of rainfall - southwest monsoon from June to September, rainfall from the tropical cyclones from October–November, and the North-East monsoon from October–December. Mid-June to December is the monsoon months in Tamil Nadu. January remains cooler, with comparatively dry days till April. Due to the cool dry weather, the growth of leptospirosis is subdued.

This similar pattern of increasing cases post-monsoon is also noted in Kerala, Karnataka, Maharashtra and other endemic areas.[3,20] Rice is the principal crop of cultivation, depends primarily on rainfall, and there is a

close interaction of soil, animals, and humans during this period. The stagnant water in the rice fields provides an ideal environment for increasing the probability of contamination. The heavy rainfall can also result in flooding and landslides, displacing rats from their habitats and moving them to human settlements, escalating the risk of infection.[2,3,8,9,10,17,20-23] On forecasting the number of cases that would be expected for the next three years using the expert modeller method, the model showed a steady increase in the number of cases each year (2024 – 3474 cases; 2025 – 3699 cases, 2026 – 4986 cases, 2027 – 5785 cases) yet following the seasonal trend as discussed above.

This study is not without limitations. Leptospirosis is a zoonotic disease greatly influenced by ecological factors like rainfall, temperature and humidity. However, these factors were not taken into consideration while forecasting the number of cases with time series analysis. This paves the scope for further research.

Leptospirosis is an emerging zoonotic disease influenced by climate and environment. This study shows a seasonal pattern of leptospirosis that is strongly interdependent with the monsoon. A significant increase in the incidence of leptospirosis is expected in the following years. Predicting the burden of the disease in advance will help public health administrators to manage the disease occurrence efficiently.

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ORIGINAL ARTICLE - PUBLIC HEALTH

GEOGRAPHICAL ACCESSIBILITY OF MATERNITY HEALTH SERVICES VIA EMERGENCY AMBULANCE IN TAMIL NADU: A SPATIAL ANALYSIS OF OBSTETRIC EMERGENCIES

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Abstract

OBJECTIVE : This study investigates the geographical accessibility of healthcare facilities for pregnancy-related emergencies in Tamil Nadu, India, utilizing data from the state-run ambulance services.

METHODS : We conducted a secondary data analysis of pregnancy-related ambulance transfers in January 2024, sourced from the GVK-EMRI emergency response centre. The study evaluated key metrics such as the distance from the scene to the hospital, time taken to reach the hospital, and the nature of obstetric emergencies. Data were analysed using descriptive statistics to understand spatial distribution and accessibility of maternal healthcare services.

RESULTS : A total of 25,780 pregnancy-related calls were recorded in January 2024. Most of the pregnancy-related calls (54.6%) were for labour, followed by medical conditions complicating pregnancy (24.9%). The analysis revealed that the median time from the scene to hospital was 10 minutes, and the median time from the call to hospital was 32 minutes. The median distance from scene to PHC was 5.6 kilometres, and 94.5% of cases reached a PHC within 30 minutes.

CONCLUSION : The study highlights the effective spatial distribution of healthcare facilities in Tamil Nadu, ensuring that pregnant women receive timely and adequate care.

KEYWORDS : Maternity Care, Geographical Accessibility, Obstetric Emergencies.

INTRODUCTION

Accessing maternity care services during pregnancy, childbirth, and postnatal period from skilled providers are crucial for the survival and well-being of the mother and newborn.[1] The spatial distance between one's residence and a healthcare facility play a significant role in accessing care during pregnancy. The decision to use facility-based maternal health services depends on the distribution of health facilities and the distance to these facilities.[2,3] Distance to health services has a dual impact: it discourages seeking care initially and serves as an obstacle once the decision to seek care is made.[4] When travel distance is far or difficult, it can deter people from seeking reproductive or antenatal care.[5] Some individuals may never visit a clinic, while others may seek care late in pregnancy or only when faced with severe medical conditions.[6] The adverse effects of distance are compounded by a lack of transport, poor roads, and low-quality care.[7] There is evidence linking the distance to facilities with health outcomes.[8] There are evidences which state that distance had a more profound influence on the choice of health facility births than quality of care.[9]

Tamil Nadu, a pioneer state in health indicators, has prioritized and invested in building health infrastructure. A recent study conducted among post-natal women in Tamil Nadu identified distance as a key factor determining the place of delivery.[10] This study also found that almost two-thirds of deliveries happen in public facilities and that 80% of women received antenatal care services at least once in public facilities.[10] Under the National Rural Health Mission (NRHM), the Government of India launched the National Ambulance Service, also known as 108, to reduce out-of-pocket expenses and prevent catastrophic costs from emergency transportation. In Tamil Nadu, the "108" Ambulance Service operates successfully through a Public-Private Partnership. It is free, available 24/7, and each ambulance has a fully trained Emergency Medical Technician who provides pre-hospital care. The top reason for using the 108 service is pregnancy-related issues (25%), followed by road traffic accidents (19%). Among pregnant women, 17% use the 108 service to reach the hospital.[12]

Thus, data from the ambulance services can provide an overview of the placement of facilities and can be used as a surrogate for measuring geographical accessibility. This study examines the geographical accessibility to health facilities for pregnancy-related calls using data from the state-run ambulance services.

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METHODOLOGY

A secondary data analysis using data from the 108-control center was conducted on all pregnancy-related transfers for January 2024. Permission to use the data obtained from GVK-EMRI. Anonymized information on pregnancy-related calls from January 1 to January 31, 2024, collected from the GVK-EMRI emergency response center database.

Variables of interest included: district, type of call, type of emergency, emergency subtype, type of transfer, time of call, day of call, time taken by the ambulance to reach the client from the time of call, time taken to reach the health facility from pick-up site, distance traveled by the ambulance from pick up site to hospital, inter-facility transfers (IFT), and the name of the facility.

IFT is defined as any transfer from one health facility to another health facility on the advice of a healthcare provider, using a '108' ambulance. All other transfers of pregnant women to health facilities using '108' ambulances were defined as 'non-IFT'. Data were extracted from the central database into Excel sheets and analyzed using Jamovi. Data was assessed for consistency, range, and missing data.

RESULTS

In January 2024, the '108' call centre in Tamil Nadu attended to a total of 25,780 pregnancy-related calls. Table 1 provides details on the types of obstetric emergencies. The most common obstetric emergency was labour, followed by medical conditions complicating pregnancy. Additionally, one in ten calls were for accessing antenatal care services. Of the total 25,780 pregnancy related calls, 14,576 (56.5%) were inter-facility transfers. Table 2 provides details on the type of pregnancy related calls at district level.

Table 1: Type of obstetric emergencies transported by '108' during January 2024, Tamil Nadu

Type of obstetric Emergency	n (%)
In Labour	14,078 (54.6)
Medical conditions complicating pregnancy	6423 (24.9)
Antenatal checkups	2570 (10.0)
Abortions	533 (2.1)
Bleeding in Pregnancy (After Delivery)	464 (1.8)
Post Caesarean in labour	396 (1.5)
Precious Pregnancy	361 (1.4)
Bleeding in Pregnancy (Before Delivery)	260 (1.0)
Delivery at Scene	249 (1.0)
Abnormal Presentations	177 (0.7)
Delivery in Ambulance	99 (0.4)
Eclampsia (Convulsions in Pregnancy)	91 (0.4)
Foetal loss	79 (0.3)

Distance travelled and time taken by '108' ambulances to transfer pregnant women is shown in Table 3. Almost 70% of the pregnant women travelled less than 10 kms in non-IFT transfers. (Figure 1) The median distances to the health centre were lowest for PHCs. The time taken in travel to reach the hospital, from the call and scene was lowest for PHCs. (Figure 2).

Table 2: Proportion of different type of obstetric emergencies for which '108' ambulance services used during January 2024 in districts of Tamil Nadu

| District	In Labor	Medical conditions complicating pregnancy	Antenatal care	Abortions	Abnormal Presentation	Bleeding in Pregnancy (After Delivery)	Bleeding in Pregnancy (Before Delivery)	Delivery at Scene	Delivery in Ambulance	Eclampsia	Foetal loss	Post Caesarian in labor	Precious Pregnancy
Ariyalur	56.9%	28.3%	0.6%	3.7%	1.4%	3.4%	1.4%	0.3%	0.6%	0.6%	0.3%	2.3%	0.3%
Chengalpattu	54.0%	36.4%	0.8%	2.8%	0.5%	0.3%	1.7%	1.2%	0.0%	0.3%	0.2%	1.2%	0.7%
Chennai	44.6%	29.5%	0.0%	3.9%	2.0%	3.0%	4.9%	0.7%	0.0%	4.3%	1.6%	3.3%	2.3%
Coimbatore	48.9%	30.0%	11.3%	1.7%	0.1%	2.0%	1.9%	0.3%	0.5%	0.1%	0.2%	1.0%	1.9%
Cuddalore	50.7%	29.9%	6.0%	3.7%	0.9%	2.9%	0.6%	0.4%	0.4%	0.6%	0.4%	2.1%	1.5%
Dharmapuri	59.2%	15.5%	17.1%	1.3%	0.6%	1.7%	0.5%	1.1%	0.4%	0.1%	0.1%	1.8%	0.4%
Dindigul	52.3%	33.6%	3.3%	0.9%	0.7%	1.5%	2.4%	0.9%	0.3%	0.4%	0.5%	1.5%	1.7%
Erode	37.2%	28.7%	22.8%	0.9%	0.4%	1.4%	0.5%	0.8%	0.5%	0.3%	0.1%	0.7%	5.8%
Kallakurichi	65.8%	22.4%	5.6%	1.4%	0.3%	1.2%	0.1%	1.6%	0.1%	0.1%	0.4%	0.5%	0.3%
Kancheepuram	70.3%	18.9%	0.0%	2.2%	0.0%	1.9%	2.2%	0.0%	0.3%	0.0%	0.5%	2.2%	1.6%
Kanyakumari	62.0%	25.9%	8.9%	0.0%	0.2%	0.4%	0.0%	0.2%	0.0%	0.2%	0.2%	0.0%	1.9%
Karur	42.0%	27.3%	23.3%	3.0%	0.8%	1.0%	1.0%	0.3%	0.0%	0.0%	0.0%	1.3%	0.0%
Krishnagiri	56.5%	28.2%	4.0%	2.3%	0.3%	3.2%	0.3%	0.8%	0.7%	0.4%	0.1%	1.9%	1.2%
Madurai	61.5%	26.2%	0.0%	3.0%	1.5%	2.3%	1.4%	0.8%	0.8%	0.6%	0.5%	0.9%	0.6%
Mayiladuthurai	68.8%	15.4%	3.0%	1.7%	0.0%	1.3%	1.3%	0.4%	2.1%	0.0%	0.0%	1.7%	4.3%
Nagapattinam	40.6%	27.4%	18.8%	4.0%	0.6%	1.8%	0.6%	0.6%	0.0%	0.3%	0.0%	2.5%	2.8%
Namakkal	43.4%	28.4%	17.3%	1.8%	1.6%	2.0%	0.8%	2.5%	0.3%	0.0%	0.3%	1.3%	1.0%
Nilgiris	51.7%	15.1%	26.3%	1.1%	0.0%	0.8%	0.4%	0.0%	0.4%	0.7%	0.3%	1.7%	1.6%
Perambalur	70.7%	12.1%	9.8%	3.3%	0.5%	1.4%	0.0%	0.0%	0.5%	0.5%	0.0%	0.0%	0.9%
Pudukottai	62.7%	17.1%	8.5%	3.2%	0.3%	1.1%	1.3%	1.1%	1.4%	0.2%	0.5%	1.3%	1.4%
Ramanathapuram	58.4%	13.1%	25.5%	0.6%	0.0%	0.3%	0.2%	0.1%	0.1%	0.0%	0.0%	0.3%	1.1%
Ranipet	59.1%	25.5%	3.7%	1.7%	0.0%	3.7%	2.7%	0.5%	0.5%	0.2%	0.2%	2.0%	0.2%
Salem	41.0%	31.1%	15.9%	1.4%	0.5%	2.5%	0.6%	2.4%	0.4%	0.4%	0.1%	3.0%	1.0%
Sivaganga	56.5%	29.2%	4.9%	1.9%	0.5%	2.5%	1.4%	0.9%	0.5%	0.2%	0.2%	0.5%	0.9%
Tenkasi	55.5%	22.8%	9.1%	3.0%	0.4%	1.9%	1.1%	2.3%	1.1%	1.1%	0.4%	1.1%	0.0%
Thanjavur	56.6%	22.8%	4.7%	4.5%	0.4%	4.1%	0.7%	1.5%	0.0%	0.2%	0.6%	3.2%	0.7%
Theni	49.5%	33.2%	0.6%	1.9%	1.3%	2.5%	0.9%	0.9%	0.3%	0.3%	0.6%	3.4%	4.4%
Thiruvallur	68.7%	12.2%	5.1%	1.6%	2.4%	1.7%	2.7%	0.5%	0.3%	0.1%	0.2%	1.7%	2.8%
Thiruvannamalai	58.1%	27.0%	0.4%	2.9%	1.3%	1.2%	1.4%	2.4%	0.7%	0.5%	0.8%	2.6%	0.7%
Thiruvarur	64.2%	19.3%	4.5%	3.3%	0.5%	1.3%	1.8%	0.3%	0.5%	0.3%	0.5%	1.5%	2.3%
Thoothukudi	60.8%	25.0%	7.6%	1.6%	1.1%	1.3%	1.1%	0.3%	0.0%	0.3%	0.0%	1.1%	0.0%
Tiruchirappalli	44.5%	27.2%	19.4%	1.7%	1.8%	2.1%	0.4%	0.0%	0.3%	0.4%	0.0%	0.9%	0.4%
Tirunelveli	38.9%	47.2%	6.9%	3.5%	1.2%	1.2%	0.2%	0.2%	0.0%	0.2%	0.0%	0.5%	0.0%
Tirupattur	56.7%	23.1%	3.8%	3.2%	0.6%	2.7%	1.6%	2.5%	1.4%	0.0%	0.5%	3.7%	0.2%
Tirupur	51.9%	31.3%	10.4%	1.1%	1.2%	1.1%	0.6%	0.9%	0.0%	0.3%	0.2%	0.1%	0.7%
Vellore	49.0%	30.8%	4.9%	3.3%	1.0%	2.3%	1.2%	2.3%	0.7%	0.5%	0.3%	3.1%	0.5%
Villupuram	58.1%	23.1%	6.8%	2.7%	0.2%	1.4%	0.3%	0.3%	0.2%	0.9%	0.7%	1.4%	3.9%
Virudhunagar	70.2%	18.3%	1.1%	1.3%	0.2%	2.1%	1.5%	1.5%	0.0%	0.2%	0.2%	1.1%	2.3%
Grand Total	54.6%	24.9%	10.0%	2.1%	0.7%	1.8%	1.0%	1.0%	0.4%	0.4%	0.3%	1.5%	1.4%
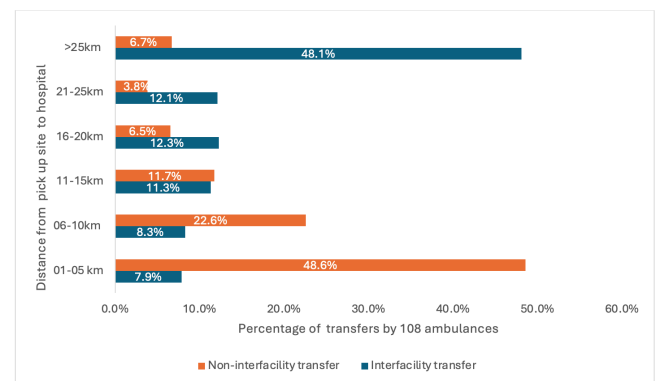
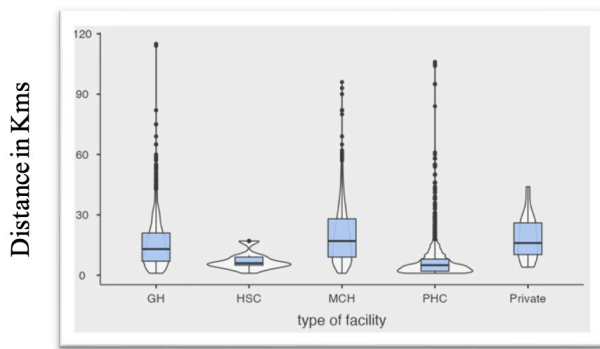*Figure 1. Distance between pick-up site to hospital for pregnancy related calls by 108 ambulances*

Table 3: Characteristics of non-interfacility transfers of pregnancy-related calls

Variables	Median (IQR)
Distance pick-up site to hospital* (km)	6 (9)
Time pick-up site to hospital* (min)	10 (16)
Time call to hospital* (min)	32.8 (31.7)

a. Distance between pick up site and hospital

b. Time pick-up site to hospital(min)
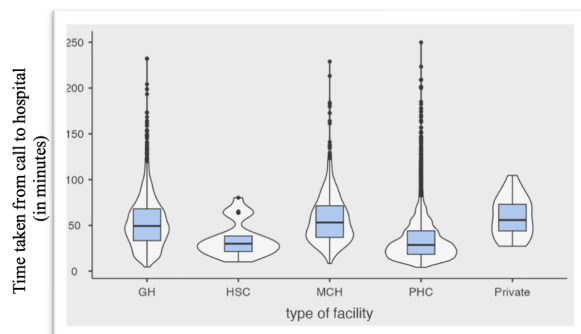
c. Time taken call to hospital(min)

Figure 2: Distance travelled and time taken for transport for non -interfacility transfers of pregnancy-related calls based on type of facility accessed in Tamil Nadu

GH- Government Hospital, HSC- Health Sub-centre, MCH- Medical College Hospital, PHC- Primary Health Centre

Among the non-IFT calls, 73.1% of the facilities where the women were dropped were PHCs. The median time taken for call to hospital and scene to hospital was minimum for PHC with 7 minutes and 28.6 minutes, respectively. (Figure 2) Similarly, it was highest for reaching the private hospitals.
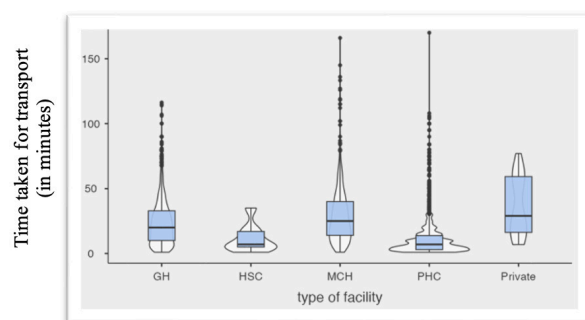
Table 4: Characteristics based on distance travelled and pick-up site for non-interfacility transfer pregnancy related calls- based on type of facility accessed.

Type of facility	Distance < 5kms n (%)	Pick-up site to hospital < 30 minutes n (%)
PHC (n-8190)	4041 (49.3%)	7743(94.5%)
GH (n-2166)	322 (14.9%)	1504(69.4%)
MCH (n-797)	65 (8.2%)	468 (58.7%)
Private (n-26)	2 (7.7%)	13 (50%)
Any facility	4435(39.6%)	9750 (87%)

GH- Government Hospital, MCH- Medical College Hospital, PHC- Primary Health Centre

Overall, 87% of any facility type was reached within 30 minutes and almost 40% of the facilities are located within 5 kilometres from the pick-up site. (Table 4)

DISCUSSION

The study analysed the geographical accessibility to health facilities for pregnancy-related calls using the '108' ambulance services in Tamil Nadu. The findings demonstrate a favourable spatial distribution of health facilities, particularly Primary Health Centres (PHCs), for maternal care.

Our data shows that for non-Inter-Facility Transfers (non-IFT), 70% of the pregnant women were within 10 kilometres of a health facility, with the lowest median distances being to PHCs. Specifically, 49.3% of the women were within 5 kilometres of a PHC, and 94.5% of the transfers to PHCs were completed within 30 minutes from the scene of emergency. The analysis shows that PHCs are strategically located for easy accessibility. This proximity is significant because it ensures quick access to maternal care, reducing delays that could lead to adverse outcomes.

Comparing these results with the study by Singh et al., it becomes evident that Tamil Nadu's healthcare infrastructure is well-placed to handle maternal emergencies.[13,14] Singh et al. reported median distances of 15 kilometres and median travel times of 63 minutes for reaching the nearest hospital from the scene, which are higher than the figures observed in Tamil Nadu.[13,14] Our findings indicate median distances of 6 kilometres and travel times of 10 minutes for non-IFT scenarios, demonstrating more efficient spatial distribution and quicker access to care.

Furthermore, the time taken from call to hospital in our study was significantly lower, with a median of 32.8 minutes compared to the 63 minutes reported by Singh et al. This discrepancy underscores the effectiveness of Tamil Nadu's ambulance service and the strategic placement of health care facilities, ensuring that pregnant women receive

timely medical attention. Considering the three-delay model in maternal mortality, this paper indicates that with the 108 ambulance services, we are able to reduce the second delay, which is the delay in reaching the hospital from home, to less than thirty minutes. The list of PHCs, including their locations and contact details, is available on the website of the Directorate of Public Health and Preventive Medicine which can be used by the public for their taking decision on choosing their facility closer to them. (https://www.tndphpm.com/#/NearByPHC)

Given the effectiveness of PHCs in providing quick access to care, continued investment in PHC infrastructure is recommended, which includes ensuring they are well-equipped and staffed to handle maternal health emergencies. Increasing public awareness about the availability and importance of emergency ambulance services and the location of the nearby public health facilities for maternal care can enhance their utilization, ensuring more women benefit from timely medical intervention. The limitation of this study is its reliance on data from a single month which may not capture long term trends. Other factors which can influence transport times such as road conditions, traffic, and weather, were not accounted for in the analysis. Also, this study included only those women who used 108 ambulance services for transport for pregnancy related issues.

The strategic spatial distribution of PHCs in Tamil Nadu has proven effective in ensuring timely access to maternal care. Most pregnant women in emergencies are within a short distance of a health facility, particularly PHCs, which significantly reduces the time from the scene to the hospital. The proximity and efficient response times highlight the success of the '108' ambulance services and the state's healthcare infrastructure in addressing maternal health needs.

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ORIGINAL ARTICLE - PUBLIC HEALTH

CORRELATION OF LEFT VENTRICULAR EJECTION FRACTION WITH PROTEIN ARGININE METHYLTRANSFERASE-1 MRNA EXPRESSION IN PATIENTS WITH DILATED CARDIOMYOPATHY: A CROSS-SECTIONAL STUDY

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Abstract

INTRODUCTION : In dilated cardiomyopathy (DCM) patients, elevated circulating asymmetric-dimethylarginine (ADMA) concentration is well-established, however the underlying mechanism(s) for excess ADMA is unclear. Reduced circulating nicotinamide-adenine-dinucleotide (NAD+) and sirtuin1 (sirt1) mRNA expression in peripheral blood of DCM patients have been reported; whether this down-regulation influences LVEF (left-ventricular-ejection-fraction) is uncertain.
OBJECTIVE : To investigate whether the expression of cardiac genes (protein arginine methyltransferase1, PRMT1 and sirt1) and circulating analytes (ADMA and NAD+) are altered in peripheral blood and if such changes are associated with LVEF in DCM.
METHODOLOGY : Peripheral blood cells (PBCs) and plasma were isolated from sixty DCM patients. Based on LVEF, patients were categorized as moderate- or severe-left ventricular dysfunction (LVD). Gene expression was determined by quantitative reverse-transcription-polymerase-chain-reaction. Quantification of analytes was assessed by reverse-phase high-performance-liquid-chromatography.
RESULTS : In patients with severe LVD, PRMT1 mRNA and circulating ADMA were higher, while sirt1 mRNA expression and circulating NAD+ were reduced, than moderate LVD. Positive correlation exists between PRMT1 expression- and ADMA-versus decreasing LVEF. Whereas reduced sirt1 expression and NAD+ were negatively correlated with decreasing LVEF.
CONCLUSION : As disease severity increases, mRNA expression of two cardiac genes and circulating concentrations of analytes were altered, possibly reflecting stress response effects. This study shows that PBCs-signatures of arginine methylation and cardio-protection can be defined for LVEF and that the peripheral blood mRNA expressions could predict LVD.
KEYWORDS : Dilated cardiomyopathy, Heart failure, Protein arginine methyltransferase1, Sirtuin1, Asymmetric dimethylarginine, Nicotinamide adenine dinucleotide

INTRODUCTION

Dilated cardiomyopathy (DCM) has variable clinical presentation, including impaired left ventricular ejection fraction (LVEF), which progresses to heart failure (HF)1. An underlying factor in DCM is cardiomyocyte dysfunction2. Nitric oxide (NO), a vasodilator produced by endothelial nitric oxide synthase (eNOS), regulates cardiomyocyte functions. In DCM, NO signaling is impaired because of the accumulation of eNOS inhibitor asymmetric dimethylarginine (ADMA)3. Plasma ADMA concentrations

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are elevated in DCM patients. ADMA up-regulated systemic oxidative stress (OS) by promoting superoxide formation. Excess OS is a characteristic feature in DCM and HF. Thus, excess ADMA contributes to pathogenesis of HF. ADMA is biosynthesized via arginine methylation reaction, catalyzed by the redox-sensitive enzyme protein arginine methyltransferase1 (PRMT1)4. The association between excess ADMA and DCM suggests that ADMA biosynthesis by PRMT1 is altered. However, whether PRMT1 expression becomes upregulated in DCM or if PRMT1 expression is associated with LVEF is unclear, which is the base of this study.

Sirtuin-1 (sirt1), a cardiomyopathy modifier-gene, is a nicotinamide adenine dinucleotide (NAD+)-dependent histone deacetylase enzyme, which is associated with several fundamental biological processes, including OS and cardiomyocyte survival. While sirt1-overexpression in cardiomyocytes renders cytoprotection, sirt1-deficiency leads to apoptosis, excess OS and inflammation5. In HF patients, NAD+ depletion and reduced sirt1 expression in peripheral blood cells (PBCs) and cardiomyocytes contribute to HF6. The roles of PBC sirt1 mRNA and circulating NAD+ in cardiac function are poorly characterized in DCM. Our question was, whether or not, PBC sirt1 mRNA and circulating NAD+ levels are altered; and whether such changes could influence LVEF in DCM. This study aimed to define the gene expression of selected cardiac genes in PBCs and their respective circulating biochemical analytes and relate them to LVEF in order to identify whether there is a link between the elements of i) arginine methylation (PRMT1 and ADMA) and ii) cardioprotection (sirt1 and NAD+), with cardiac function, in DCM patients. We evaluated i) the mRNA levels of PRMT1 and sirt1 in PBCs and ii) the circulating concentrations of ADMA and NAD+ to echocardiographic indices of LV function in DCM patients.

METHODS

Sixty DCM patients had been enrolled from the out-patient facility in the Department of Cardiology in SRM Medical College Hospital and Research Center, Kattankulathur. This study is a hospital-based cross-sectional study, therefore convenience sampling was chosen. All patients had an echocardiographic diagnosis of DCM. This study is approved by the Institutional Ethics Committee at SRMIST, Kattankulathur, and all patients provided informed consent to participate in the study. The present study conforms to the Declaration of Helsinki for using human tissue samples or subjects. Table 1 shows the baseline data.

Echocardiography: At enrolment, echocardiographic indices were assessed by using the Epiq &c Philips ultrasound system. LVEF was calculated using the biplane Simpson's method. Based on the LVEF, patients were categorized as Group A (moderate LVD; LVEF 31 – 45%) and Group B (severe LVD; LVEF < 30%). Table 1 shows the echocardiographic parameters.

Analysis of ADMA and NAD+: Plasma and blood cells were isolated using peripheral blood samples. Following ultra-filtration of plasma samples, through 3-kDa molecular weight cut-off filters, samples were utilized for the simultaneous quantification of ADMA and NAD+ using dual wavelengths in reverse-phase high-performance-liquid-chromatography, as described.[7]

RNA isolation and qRT-PCR: Total RNA was extracted from blood cells using the TRIzol reagent (Sigma) method. The concentration and purity of RNA were determined by using the NanoDrop 2000c spectrophotometer (ThermoFisher Scientific, USA). Using PrimeScript RT reagent kit (TaKaRa bio-Inc) cDNA was synthesized. Quantitative reverse-transcription-polymerase-chain-reaction (qRT-PCR) was carried out in a Light-Cycler-480 (Roche applied science), using the TB-Green-Premix-Ex-Taq-II (Ta-Ka-Ra bio-Inc). By using the 2-ΔΔCt method, relative gene expression was calculated; data shows the normalized fold change in gene expression against GAPDH.

Primer sequences:

PRMT1:

Forward 5'-TTGACTCCTATGCCCACT-3'
Reverse 5'-CCACATCCAGCACCACC-3'.

Sirt1:

Forward 5'- TCAGCTCTGGGATGACCTT-3'
Reverse 5'- ACCATCAAGCCGCCTACTAATCTG-3'.

GAPDH:

Forward 5'- TTCAGCTCTGGGATGACCTT-3'
Reverse 5' - CTCATGACCACAGTCCATGC- 3'.

Statistical analysis: Data represent mean(s) and standard-deviation for continuous-variables or per-centages for cate-gorical-variables. Differences between the groups (A and B) were tested using student-t-test for continuous-variables and chi-square test was used for categorical variables. Correlations between continuous variables are evaluated using the Spear-man cor-relation co-efficient. Significant changes in gene-expression bet-ween the groups are evaluated by a two-tailed Mann–Whitney test. All tests were two-sided, and analysis is performed with the SPSS statistical package (Windows version 16.0). Multivariate linear regression models are obtained to establish whether the independent

variables, mRNA expressions or circulating concentrations of biochemical analytes, in the presence of other risk factors, can predict the disease severity of DCM. P-value less than 0.05 is considered stat-istically significant.

RESULTS

In DCM patients, mRNA expression levels of the two cardiac genes, PRMT1 and sirt1 in PBCs, as well as the circulating concentrations of biochemical analytes ADMA and NAD+, which are associated with the selected genes, are assessed to LVEF.

Table 1: Demographic and echocardiographic characteristics of enrolled patients

Parameters	Group A LVEF: 31 – 45 % (n=30)	Group B LVEF: 25 – 30 % (n=30)	p Value
Gender, Male (%)$	66% (20)	60% (18)	NS
Age (years)*	59.05±8.54	53.5±6.28	NS
Height (cm)*	161.9±8.46	163.5±5.25	NS
Weight (Kg)*	67.1±14.68	63.4±6.64	NS
Heart Rate (bpm)*	76.3±8.75	76.4±11.16	NS
Systolic BP (mmHg)*	120. 5±14.68	127±17.67	NS
Diastolic BP (mmHg)*	77±9.79	78±11.35	NS
Hypertension	33%	40%	NS
Diabetic	43%	50%	NS
CAG – Normal (%)$	70%	70%	NS
CAG – SVD (%)$	20%	30%	NS
CAG – DVD (%)$	10%	0%	NS
Beta Blockers$	60%	45%	NS
Diuretics$	80%	55%	NS
Antiplatelet$	90%	85%	NS
Statins$	80%	95%	NS
LVEF (%) – Simpson	32.77±4.57	27.6±1.58	< 0.0001
LV mass (g)	228.13±41.72	231.2±22.58	NS
EDV (mL)	152±37.7	140.1±5.43	NS
ESV (mL)	101±21.71	104.8±11.49	NS
SV (L/min)	48.5±20	35.5±10.19	0.0092
CO (L/min)	3.09±1.09	2.919±0.72	NS
LVIDD (cm)	5.62±0.27	5.73±0.18	NS
LVIDS (cm)	4.67±0.27	4.77±0.27	NS
E (cm/s)	0.69±0.18	0.82±0.1	0.0021
A (cm/s)	0.58±0.26	0.33±0.08	< 0.0001
E/A	1.6±1.25	2.585±0.85	0.0011
e' Septal (cm/s)	0.05±0.01	0.047±0.01	NS
E/e' Septal	13.6±4.21	17.55±2.34	< 0.0001
e' Lateral (cm/s)	0.07±0.01	0.065±0.01	NS
E/e' Lateral	10.51±2.97	12.8±1.87	0.001
GLS (%)	-9.32±5.06	-7.623±1.77	NS

Table 1. Demographic and echocardiographic characteristics of enrolled patients. Data are presented as mean ± standard

deviation. A – atrial systole, BP – blood pressure, CAG – coronary angiogram, CO – cardiac output, DVD – double vessel disease, E – early rapid filling in diastole, E/e' - ratio of transmitral blood flow velocity to tissue doppler velocity, e' – early diastolic filling velocity, EDV – end diastolic volume, ESV – end systolic volume, GLS – global longitudinal strain, LV mass – left ventricular mass, LVEF – left ventricular ejection fraction, LVIDD – left ventricular internal dimension in diastole, LVIDS – left ventricular internal dimension in systole, NS – non significant, SV – stroke volume, SVD – single vessel disease.

Demographic and clinical characteristics of patients, along with baseline echocardiographic parameters, are shown in Table.1. In the echocardiographic parameters, statistically significant differences between the groups were observed for LVEF, stroke volume (SV), E wave, A wave, E/A, E/e' septal and E/e' lateral (p<0.05).

In severe LVD, PRMT1 and ADMA are up-regulated, however, sirt1 and NAD+ are down-regulated, than in moderate LVD (Figure 1, A-D). A significant negative correlation exists between ADMA concentration and PRMT1 mRNA expression versus LVEF (Figures 2A and 2C). A significant positive correlation exists between NAD+ concentration versus LVEF and sirt1 mRNA expression versus LVEF (Figures 2B and 3D). These observations suggest that elements associated with arginine methylation (PRMT1 and ADMA) are up-regulated, however, cardioprotective elements (sirt1 and NAD+) are down-regulated, as LVEF decreases.

Multivariate linear regression analysis models are derived to investigate the relationships between gene expression, biochemical analytes, and LVEF (Table 2). Before or after adjusting for demographic factors and cardiovascular models, all the models showed that LVEF was significantly associated with PRMT1 gene expression and circulating analytes (ADMA, sirt1, and NAD+). Therefore, changes in the gene expression of PRMT1 and sirt1 and circulating analytes could be associated with LVEF.

Figure 1. Comparison of concentrations of circulating analytes (ADMA (A) and NAD+ (B)) and gene expression levels (PRMT1 (C) and Sirt1 (D)) in peripheral blood of dilated cardiomyopathy patients according to left ventricular ejection fraction (LVEF). Group A - moderate LV dysfunction with LVEF 31 – 45%; Group B – severe LV dysfunction with LVEF < 30%; AU – arbitrary units; ADMA – asymmetric dimethylarginine; NAD+ – nicotinamide adenine dinucleotide; PRMT1 – protein arginine methyltransferase1; Sirt1 – sirtuin1. Data are presented as mean ± SD. *P<0.05.
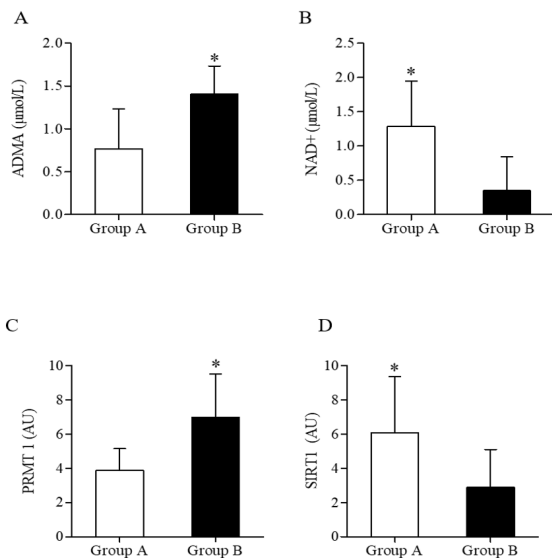
Figure 2. The associations between percentage of the left ventricular ejection fraction and circulating analytes (ADMA (A) and NAD+ (B)) and peripheral blood mRNA expression (PRMT1 (C) and Sirt1 (D)) in dilated cardiomyopathy patients (n=60, Spearman correlation analysis). AU – arbitrary units; ADMA – asymmetric dimethylarginine; NAD+ – nicotinamide adenine dinucleotide; PRMT1 – protein arginine methyltransferase1; Sirt1 – sirtuin1.
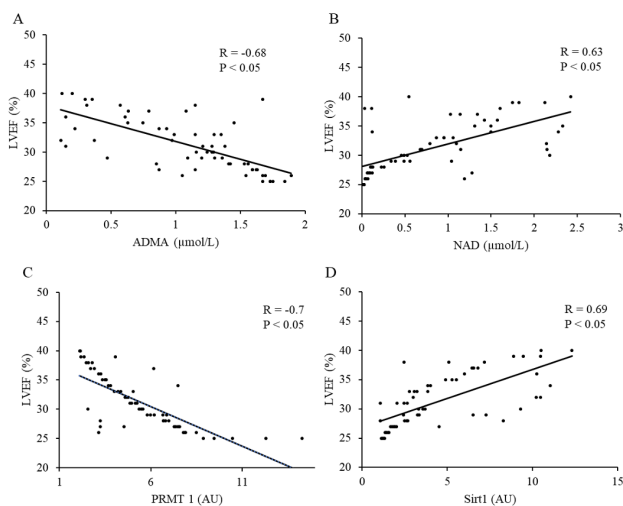
INDEX	MODEL 1			MODEL 2			MODEL 3		
	β	95% CI	P-value	β	95% CI	P-value	β	95% CI	P-value
ADMA	-0.07	-0.09, -0.05	1.19E-09	-0.07	-0.09, -0.05	4.54E-10	0.07	-0.09, -0.05	1.12E-09
PRMT 1	-0.42	-0.51, -0.32	3.55E-12	-0.41	-0.51, -0.31	1.24E-11	-0.40	-0.49, -0.30	1.53E-11
NAD+	0.10	0.06, 0.13	6.48E-08	0.10	0.07, 0.13	5.41E-08	0.10	0.07, 0.13	5.68E-08
Sirt1	0.48	0.35, 0.62	6.98E-10	0.10	0.07, 0.13	5.41E-08	0.48	0.34, 0.61	2.09E-09

Table 2. Multivariate Regression Analysis. ADMA – asymmetric dimethylarginine, NAD+ – nicotinamide adenine dinucleotide+, PRMT1 – protein arginine methyltransferase1, Sirt1 – sirtuin1. Model 1: no covariate; Model 2: includes age and gender as covariates; and Model 3: includes age, gender and traditional cardiovascular risk factors (type-2 diabetes, arterial hypertension) as covariates.

DISCUSSION

The current study shows the differences in the expression of cardiac genes (PRMT1 and sirt1) in PBCs and circulating concentrations of biochemical analytes (ADMA and NAD+) appear to be associated with LV function in DCM. Our study provides data for the first time, that suggests, in DCM patients, when LVEF decreases i) PRMT1 mRNA expression is upregulated in blood cells and that it could be an underlying factor for the excess circulating ADMA concentration; ii) PBC sirt1 mRNA expression and circulating NAD+ concentration are down-regulated; iii) a correlation exists between the transcript levels of genes (PRMT1 and sirt1) and LVD. These observations imply that changes in PBC mRNA expression and concentration of circulating analytes indicate the disease severity in terms of LV function and that it is possible that peripheral blood (PBCs and plasma) could be an alternative sample for the gene expression analysis (of PRMT1 and sirt1) and to monitor the disease progression in DCM; and iii) Multivariate regression analysis revealed that the increase in PRMT1 mRNA expression, decrease in sirt1, elevated ADMA concentration and decrease in NAD+ concentration are independent predictive factors for the decrease in LVEF, suggesting that the elements of arginine methylation (PRMT1 and ADMA) and cardioprotective factors (sirt1 and NAD+) have an antagonistic effect on the LV function. Therefore, it is possible that the components of arginine methylation and cardio-protection could predict LVD.

PRMT1 – ADMA – LVEF: As for the molecular mechanism that leads to excess ADMA, our data indicates that PRMT1 gene expression is upregulated in severe LVD than in moderate LVD. Studies have shown that i) ADMA accumulation is an indicator of excess systemic OS; OS is upregulated in failing hearts[8] and iii) excess OS triggers PRMT1 expression and thus ADMA accumulation.[9] Based on this evidence and our observations, excess systemic OS may lead to increased PRMT1 mRNA, which results in excess circulating ADMA. On the link between ADMA and LVEF, ADMA alters the LV structure and function, and remodeling processes. ADMA is one of the biomarkers of myocardial injury and remodeling in HF and ADMA is an independent risk factor for several pathological conditions that contribute to the development of HF, including hypertension and coronary artery disease.[10] Hence, it is possible that in DCM upregulated PRMT1 expression regulates LVEF via excess ADMA biosynthesis.

Sirt1 – NAD+ – LVEF: Reduced myocardial sirt1 expression[11] and NAD+ concentration12 contribute to the pathogenesis of DCM6.[13] Our observation shows that sirt1 expression and plasma NAD+ concentration are impaired, wherein severe LVD (group B) had significantly lower sirt1 and NAD+ than the moderate LVD (group A). This finding indicates that reduced sirt1 mRNA in blood cells and, or diminished circulating NAD+ concentration, may reflect LV systolic dysfunction.

Physiologically, sirt1 and NAD+ elicit cardioprotection by detoxifying OS and regulating energy production. Under excess OS, as in DCM and HF, surplus free radicals attenuate NAD+ and sirt1. These effects cumulatively result in cardiac remodelling and impaired cardiac performance.[14] Thus, in this study, it is possible that reduced sirt1 mRNA and, or NAD+ concentration could mediate the changes in redox imbalance, which affects the LVEF and results in LVD in DCM.

CONCLUSION

In DCM patients, LVEF deterioration appears to be associated with two events: alterations in the i) expression of genes associated with arginine methylation and cardioprotection in PBCs, and ii) circulating concentrations of ADMA and NAD+.

LIMITATIONS

1. A Major limitation is the small sample size.
2. Instead of assessing the direct enzyme activities of PRMT1 and sirt1, indirect activities were determined.
3. We could not determine the cause of the relationship between altered mRNA expressions and deteriorating LVEF, as this investigation was cross-sectional.
4. We could not establish the role of the DCM milieu in the levels of mRNA and analytes because healthy control subjects were not recruited in this study.

ACKNOWLEDGEMENT

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TRANSLATION, CULTURAL ADAPTATION AND VALIDATION OF THE LIVING WITH MEDICINES QUESTIONNAIRE INTO THREE REGIONAL LANGUAGES (TAMIL, TELUGU AND HINDI) IN INDIA

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Abstract

INTRODUCTION : To assess, from a patient's point of view, the issues related to the burden resulting from the use of medicines, the Living with Medicines Questionnaire version 3 has been developed in English.

OBJECTIVE : To translate and culturally adapt the LMQ version 3 into three regional languages in India.

METHODOLOGY : Permission to translate the LMQ-3 was obtained from the original developers, and a translation and adaptation protocol based on the International Society of Pharmacoeconomics and Outcomes Research guidelines has been developed using patient-reported outcome measures. To produce the first reconciled version, translated back into English, two forward translations from English into the Indian regional language (Tamil, Telugu, and Hindi) have been developed and compared.

RESULTS : Rewording of certain items within this instrument has addressed the issues found and those relating to Cultural and Conceptual equivalence with respect to some terms. The translation process and cognitive debriefing exercise generated comments regarding the original tool's construct and its Tamil, Telugu and Hindi equivalents, which were communicated to the developers of the LMQ for their consideration while conducting further comparative studies.

CONCLUSION : To be able to use it in research and clinical practice in Tamil, Telugu and Hindi-speaking people in India, a culturally appropriate translation of the LMQ version 3 has been developed. It is recommended and envisaged that this developed version of these languages will continue to be validated.

KEYWORDS : Translation, Cultural Adaptation, Validation, Living with Medicines Questionnaire, three regional languages.

INTRODUCTION

In the managing of chronic diseases, medicines constitute the most commonly used form of treatment.[1] Multiple medicinal products, especially for patients with multimorbidity, are often prescribed for the clinical management of different chronic conditions. The routine of taking medicines, adverse reactions, nature of the medication, regimen challenges associated with the healthcare system, access to medications, and interference with social activities often result in medication-related burdens for patients.[2] The burden of medication may be detrimental to an individual's social, psychological, and physical well-being.[5] A critical humanistic dimension that needs to be evaluated in all patient-centered interventions is the social, psychological, and physical impact of medication therapy on patient's lives. To assess aspects related to patient's use of medicine, several instruments have been created. However, there are still insufficient evidence-based tools in the literature to evaluate the burden on patients from a patient's point of view regarding medication use. Krska et al. have developed and validated the Living with Medicines Questionnaire (LMQ), which is intended to examine several aspects related to

the burden of medicine use from a patient's point of view. Based on earlier qualitative investigations, the LMQ was developed for patients with chronic morbidities. Validations for comparative psychometric evaluations of this tool were conducted in several countries, including England, Australia, Ireland, and the Netherlands.[10,11] Feedback from patients to date indicates that the questionnaire is an effective tool in assessing a range of problems, such as adherence to treatment plans, patient relationships with healthcare providers, and concerns related to drug side effects.[9] To our knowledge, tools are not available for assessing patient's perceptions of the burden related to the use of medicinal products in an Indian language (Tamil, Telugu, Hindi) context. Additionally, there has not been a third version of the LMQ in these languages, which are among the most commonly spoken languages in India. To that end, this study aims to participate

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in international instrument development efforts to make culturally acceptable tools available. This will be a valuable tool to help us assess how patients feel about their treatment and its effects on their lives. In this way, tailored interventions designed to reduce the use of medicines in patients with chronic illnesses who receive multiple medicinal products will also be facilitated.

METHODOLOGY

Description of LMQ 3:

The LMQ version 3, developed by Krska et al., contained 41 statements with which the respondents indicated their level of agreement using a five-point Likert-type scale (from strongly agree to disagree). Furthermore, the patient was able to add any additional pertinent issues that did not appear on the questionnaire by means of a freely readable question. Eight domains covered by the tool include interactions with healthcare professionals, practicalities, information, effectiveness, adverse reactions, attitudes, impacts, and control. Additionally, a visual analogue scale (VAS) was used, which allowed the patient to express how much of a burden they felt from their entire medicine regimen on a range of 0 (no burden at all) to 10 (very burdensome). Initial versions of this VAS did not have distinct points with scores ranging from 0 to 10, However, the developers later accepted the scoring.[13]
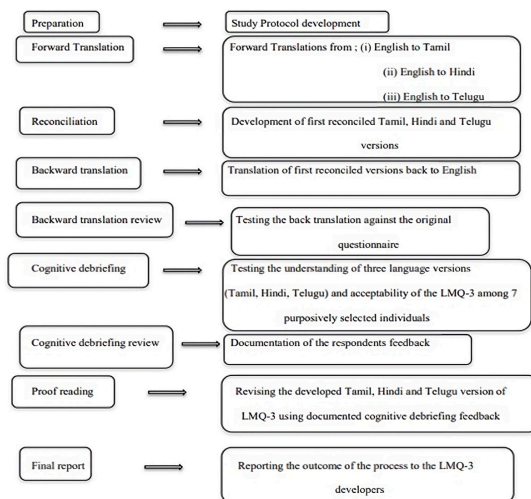

Figure 1: Steps for the translation and cultural adaptation of the LMQ 3 into Tamil, Hindi and Telugu (based on ISPOR guidelines).

The Translation and Cultural Adaptation Process: In this study, the ISPOR Guidelines for adaptation, validation and translation of questionnaires regarding PRO measurement have been used by the International Pharmacoeconomics and Outcomes Research Society. (Figure 1)

Preparation

The original authors of the questionnaire i.e., Krska et al. have given their permission to use the LMQ version 3. A comprehensive study protocol has been drawn up and shared with the developers, giving them a clear overview of the design, methodology and anticipated project results. Throughout the development of a Tamil version of the questionnaire, developers have provided detailed information and explanations where necessary. The multistage process for the developing of a three-languages (Tamil, Hindi and Telugu) version of the questionnaire is illustrated in Figure 1, which shows results at each stage.

Forward translation

Two independent, multilingual, and trained translators carried out two different translations of the LMQ-3 from (i) English to Tamil, (ii) English to Hindi, and (iii) English to Telugu. The contents of this tool have not been informed to the translator with experience working in PROs before their translation.

Reconciliation

A panel composed of five study investigators (Four of whom were fluent in English, Tamil, Hindi and Telugu) and the translators convened on several occasions to develop three language versions of the LMQ-3 translations. This was done to eliminate any discrepancies in translation and to ensure cultural equivalence. This generated the first reconciled Tamil, Hindi and Telugu versions of the LMQ-3.

Back translation and review

A third independent, bilingual and qualified translator who was not familiar with the original English version 3 of the LMQ has translated the first reconciled Tamil, Telugu and Hindi versions back into English to test the quality of the translation and to ensure that the intended meanings of all the items were maintained. A review of the results in this step has resulted in further enhancement of the three languages questionnaire and a second harmonised language version. A step of harmonization was taken at this point in time, as indicated by the ISPOR (The International Society for Pharmacoeconomics and Outcomes Research) Guidelines to guarantee equivalence between differing versions of the developed texts. It is advisable to harmonize when a tool of interest is transferred over to multiple languages. In this work, steps are undertaken to ensure comparability between all three language versions through joint discussions among translators.

Cognitive debriefing and review

Each Ten Tamil, Hindi and Telugu-speaking people were purposively chosen for the cognitive debriefing. To give equal

representation between the sexes, ages, and occupation, these participants have been selected (Table 2,3,4). Although it was intended to ensure that the developed version of Tamil could be understood by the general population, a large proportion of those selected had at least one chronic condition. Respect comprehension, time pressures and acceptability they gave their comments on the 2nd corrected version of the LMQ-3 Tamil, Hindi, Telugu languages. In this review of the cognitive debriefing procedure, discussions have resulted in a revising of previous steps to deal with cultural and linguistic issues. Investigators could also able to evaluate whether the original LMQ version 3 content was acceptable and communicate it to developers of an initial version through a cognitive debriefing process.

Proofreading and final report

To provide a final translation, investigators of the study have carried out careful reviews of the English version 3 of the LMQ. A final report was developed and submitted to the LMQ developers on the original version of the LMQ-3 with three languages (Tamil, Hindi. Telugu) translations, methods for generating a translated version as well as its findings during linguistic validation.

RESULT

Translation and Cultural Adaptation

Statements of the instrument were evaluated carefully by the study investigators at the semantic, conceptual, and cultural levels. In that regard, certain words have been modified to retain the intended meaning and heading of the statement to be able to meet the regional language context. (Table 1)

Table 1: Issues resolved in the translation and cultural adaptation of the LMQ 3

Item	Translation Issue	Action
Item 11 - I can vary the dose of the medicines I take	A literal translation may change the direction of the item and may give the meaning that the patient will change the dose regardless of the need.	It was translated to express the confidence that respondents would have to tailor the dose as per their needs, which is the intended meaning of the item.
Item 4 - I am comfortable with the times I should take my medicines.	When back-translated into English, the term "comfortable" became "relieved". This would change the meaning and the direction of the item.	The word 'comfortable' has been converted into a phrase indicating acceptance.
Item 17 - I am concerned that my medicines interact with alcohol	Cultural adaptations have been made to ensure that the respondents can answer this question because alcohol consumption, despite its widespread occurrence in Indian society, particularly for women, is not a normal part of their culture.	This was translated into Tamil which meant "I am concerned that my medicines interact with my nutritional habits (other foods, alcohol, drinks)." The same translations were applied to Hindi and Telugu languages.
Item 41 - My life revolves around using my medicines.	It would be difficult to understand and convey different meanings and directions of the item if translated literally.	The sentence "using medicinal products constitutes a substantial part of the patient's life" was added to this item.

Table 2: Participants (Tamil native speakers) selected for cognitive debriefing

Participants (Tamil Native Speakers)	Sex	Age (y)	Occupation	Interview place	Interview duration (min)
P1	Female	27	Pharmacist	Hospital	45
P2	Female	42	Software engineer	Home	60
P3	Male	48	Private bank Manager	Bank office	50
P4	Female	23	Housewife	Home	60
P5	Female	32	Lecturer	Home	60
P6	Male	56	Real estate	Participant office	45
P7	Male	50	Laborer	Worksite	45
P8	Female	36	Customs officer	Home	40
P9	Male	60	Professor	Home	70
P10	Female	55	Professor	Home	75

Table 3: Participants (Telugu native speakers) selected for cognitive debriefing.

Participants (Telugu Native speakers)	Sex	Age (y)	Occupation	Interview place	Interview duration (min)
P1	Male	45	Business	Home	45
P2	Male	32	Sales development	Participant Office	45
P3	Female	56	Housewife	Home	50
P4	Male	47	Business	Participant Office	50
P5	Female	29	Accountant	Home	40
P6	Female	39	Housewife	Home	45
P7	Male	60	Mechanic	Work site	30
P8	Male	42	Driver	Home	45
P9	Female	57	Housewife	Home	40
P10	Female	62	Retired Professor	Home	60

Table 4: Participants (Hindi native speakers) selected for cognitive debriefing

Participants (Hindi Native speakers)	Sex	Age (y)	Occupation	Interview place	Interview duration (min)
P1	Male	28	Building Worker	Home	70
P2	Female	39	Housewife	Participant Office	45
P3	Female	54	Housewife	Home	60
P4	Male	45	Business	Participant Office	65
P5	Male	31	Building Worker	Home	45
P6	Female	37	House wife	Home	60
P7	Male	53	Business	Worksite	60
P8	Male	47	Business	Home	70
P9	Male	34	Sale representative	Home	45
P10	Female	48	Assistant Professor	Home	70

Visual Analogue Scale and Cognitive Debriefing

A decision was made, through discussions among the research investigators, to change the VAS to one with discrete graduation between 0 (no burden at all) and 10 (extremely burdensome).

The recommended change has been communicated to the developers of the first instruments has been approved by them. The rationale behind adding discrete ratings to the VAS was that they could be used as a basis for providing an overall global assessment of the burden of medicine use. This would enable measuring associations with the entire LMQ version 3 scores and their respective domains.

Almost all of the interviewed individuals commented on the length of the questionnaire (41 items) and the presence of some items that clustered around similar meanings. For instance, item 3, "I am pleased with the efficacy of my medicines," and item 25, "My medicinal products are in line with my expectations" were used by some respondents to measure their effectiveness. However, there were no suggestions to modify those issues since they have slight differences in their very close relationship.

DISCUSSION

The first attempt to introduce an instrument to assess the burden of the use of medicinal products from the patient's point of view was made with the development of the LMQ. This study adds to evidence that compared to healthcare providers, patients have different perceptions of issues relating to the use of medicines.[17]

Although methodologies may differ, we have undertaken to follow the best practices laid down by ISPOR to ensure reliable and robust results in studies concentrating on cultural adaptation measures. Before conducting the forward-backward translation, the investigators tried to characterize the concept tool of interest measures among the target population (English-speaking).

Apart from the diverse types of instruments adapted, this diversity can be attributed to enormous differences between languages, cultures and places where these studies were carried out. To help interpret the findings resulting from using this tool, which was supported by the development community, the researchers of that study favoured a grade VAS with scores between 0 and 10; an option endorsed by the developers. And to assess the comprehension and duration of the questionnaire, cognitive debriefing interviews have been carried out.[12] Given the development of the LMQ, which is based on qualitative patient opinions about medication issues, a general good level of understanding was expected achieved about nearly all statements in the tool. In most of the guidance on translation and cultural adaptation to PRO instruments, native speakers of the original language who are also fluent in their target language should be used for back translations. It was hard to find a person in our area with that those characteristics. A qualified bilingual translator, whose mother tongue was Tamil, Telugu and Hindi and who was familiar with Western culture, had translated our study back to translation. In addition, before its use for research and medical practice, it is essential to conduct out further studies to establish the psychographic characteristics of the produced Tamil version amongst Tamilian populations in Tamil Nadu, state of India. Similarly for Telugu and Hindi version among the Telugu and Hindi speaking populations. It is necessary to measure in particular the validity of construction and its internal consistency.[19]

CONCLUSION

It is our belief that the translation and cultural adaptations of the LMQ-3 beyond English to other language countries will have a significant input, complementing work already carried out by LMQ developers in other languages. This work also provides for the release to the public, in a strong translation process, a Tamil, Telugu and Hindi versions of the LMQ-3 which is functionally similar to the English language tool.

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ORIGINAL ARTICLE - PUBLIC HEALTH

DESCRIPTIVE ANALYSIS ON PHYSIOTHERAPY SERVICES PROVIDED UNDER MAKKALAI THEDI MARUTHUVAM SCHEME (MTM) IN TAMIL NADU

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Abstract

INTRODUCTION : Non-communicable diseases (NCDs) are a global health challenge with profound socio-economic implications1. The burden of NCDs is staggering, with the World Health Organization (WHO) estimating that they are responsible for approximately 71% of all global deaths, equivalent to around 41 million people each year.[3] The "Makkalai Thedi Maruthuvam" scheme, launched by the Government of Tamil Nadu, embodies a visionary approach to healthcare delivery, particularly in rural areas. Physiotherapy plays a crucial role in rehabilitating individuals with physical disabilities, musculoskeletal disorders, and chronic conditions, enhancing their mobility, function, and quality of life.

OBJECTIVE : To estimate the coverage of physiotherapy services provided under the Makkalai Thedi Maruthuvam (MTM) scheme in Tamil Nadu. To assess the Health Unit District (HUD) wise performance of physiotherapy services Makkalai Thedi Maruthuvam (MTM) scheme in Tamil Nadu.

METHODOLOGY : A descriptive study was done among all beneficiaries of the Physiotherapy service under the Makkalai Thedi Maruthuvam scheme (MTM) in Tamil Nadu till 30.5.2024.

RESULTS : On analysing the most common and frequent diseases covered under physiotherapy services, it was found that Osteo/spondylo/Rheumatoid arthritis (17.3%) and Chronic arthritis (17%) were those covered most often. Motor neuron disease and Parkinson disease were the least covered. Regarding the districts with maximum performance block-wise, Ranipet district tops the list followed by Ariyalur and Dindigul.

CONCLUSION : This study provides a descriptive overview of the overall coverage of physiotherapy services under the Makkalai Thedi Maruthivam scheme. It also gives some picture of the HUD-wise district performance of these services.

KEYWORDS : Home-based Physiotherapy services, Makkalai Thedi Maruthuvam, Arthritis

INTRODUCTION

Non-communicable diseases (NCDs) are a global health challenge with profound socio-economic implications1. Unlike infectious diseases, NCDs are not transmitted from person to person but are primarily caused by a combination of genetic, physiological, environmental, and behavioral factors.[2] This category encompasses a diverse range of conditions including cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes, among others. Burden of NCDs is staggering, with the World Health Organization (WHO) estimating that they are responsible for approximately 71% of all global deaths, equivalent to around 41 million people each year3. Alarmingly, the prevalence of NCDs is steadily rising, particularly in low- and middle-income countries where resources for prevention, diagnosis, and treatment are often limited.

India is undergoing a rapid epidemiological transition, characterized by a shift from communicable to non-communicable diseases as the leading causes of morbidity and mortality. This transition is driven by urbanization, lifestyle changes, an increasing ageing population, and improvements in healthcare that have led to longer life expectancies.[4] There are significant socioeconomic disparities in the burden of NCDs within India. While NCDs affect individuals across all socioeconomic strata, those from lower-income groups often face greater challenges in accessing preventive, diagnostic, and treatment services due to financial constraints and limited healthcare infrastructure in rural areas. India's healthcare infrastructure varies widely across different states and regions. While some states have made significant progress in strengthening healthcare systems and implementing NCD prevention and control programs, others face challenges related to inadequate infrastructure, healthcare workforce shortages, and limited access to essential medicines and technologies.

Tamil Nadu has made notable strides in healthcare delivery, with a well-established network of primary healthcare centers, secondary hospitals, and tertiary care

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facilities. The state has also implemented several initiatives to address NCDs, including the establishment of NCD clinics, screening programs, and awareness campaigns. Like the rest of India, Tamil Nadu grapples with a high burden of NCDs, particularly cardiovascular diseases, diabetes, and cancer. Urbanization, changing dietary patterns, and lifestyle factors contribute to the rising prevalence of these diseases in the state.

"Makkalai Thedi Maruthuvam" scheme, launched by the Government of Tamil Nadu, embodies a visionary approach to healthcare delivery, particularly in rural areas. Translating to "Healthcare at the People's Doorstep," this initiative aims to enhance access to essential healthcare services for marginalized communities by deploying mobile medical units equipped with diagnostic tools and medical personnel to remote and underserved regions.[5]

Through this scheme, individuals in Tamil Nadu, especially those residing in rural and inaccessible areas, receive vital preventive, diagnostic, and therapeutic interventions without the barrier of distance. By bringing healthcare directly to the people, Makkalai Thedi Maruthuvam empowers communities to proactively manage their health, thus contributing significantly to the state's efforts in achieving comprehensive healthcare coverage and ensuring equitable access to healthcare for all its citizens. Under the Makkalai Thedi Maruthuvam scheme in Tamil Nadu, the inclusion of physiotherapy and palliative care services underscores a holistic approach to healthcare delivery.

Physiotherapy plays a crucial role in rehabilitating individuals with physical disabilities, musculoskeletal disorders, and chronic conditions, enhancing their mobility, function, and quality of life. By integrating physiotherapy into the scheme, individuals in remote and underserved areas gain access to rehabilitative services that may otherwise be inaccessible.

Together, the integration of physiotherapy services within the Makkalai Thedi Maruthuvam scheme demonstrates the state's commitment to delivering comprehensive and inclusive healthcare services that address the diverse needs of its population, including those living in remote and marginalized communities. This study provides a descriptive overview of the Physiotherapy services under the Makkalai Thedi Maruthuvam scheme and its effectiveness. We estimated the coverage of Physiotherapy services provided under the Makkalai Thedi Maruthuvam (MTM) scheme in Tamil Nadu and assessed the Health Unit District (HUD) wise performance of Physiotherapy services in Makkalai Thedi Maruthuvam (MTM) scheme in Tamil Nadu.

METHODOLOGY

A descriptive study was conducted using data extracted from the MTM portal on the physiotherapy services provided to beneficiaries under the MTM scheme. The portal contains details on the total beneficiaries count, a list of diseases covered under the umbrella of physiotherapy services, and the status of treatment under current treatment, handed over to the beneficiary family for continuation of the service, treatment terminated, and death.

All the data entered in the portal since the inception of the program in 2021 till 30.05.2024 were included in the analysis. Along with this data, the total number of blocks was also collected from the respective HUDs and compiled to get the block-wise results. After extraction, the data was compiled in Microsoft Excel and analyzed using SPSS, version 16. HUD-wise coverage and block-wise coverage are expressed as percentages. The data reflected on the portal are the abstract numbers. Permission was obtained from the Director of Public Health to extract and analyze the data.

RESULTS

The total number of beneficiaries who received physiotherapy services under the MTM scheme was 5,98,912 patients. The diseases covered under the physiotherapy services include hemiplegia, Parkinson's disease, Chronic arthritis, Rheumatoid / spondylo /Osteo arthritis, Cerebral palsy, Muscular dystonia, Motor Neuron Disease, and Others.

The district-wise number of beneficiaries who received physiotherapy services per lakh population is given in Table 1.

Table 1: District-wise performance of physiotherapy services per lakh population under Makkalai Thedi Maruthuvam (MTM) Scheme, Aug 2021 to May 2024, Tamil Nadu

Name of the Health Unit Districts	Number of beneficiaries per lakh population (N=598912)
Ariyalur	2406
Ranipet	2233
Karur	1805
Dindigul	1678
Nagapattinam	1365
Cheyyar	1252
Thiruvannamalai	1241
Thiruvarur	1227
Paramakudi	1185
Tiruppur	1147
Virudhunagar	1121
Palani	1021
Erode	985
Salem	928
Vellore	859

Vellore	859
Cuddalore	859
Mayiladuthurai	836
Coimbatore	817
Dharmapuri	803
Sivagangai	782
Thiruchirappalli	774
Thiruvallur	761
Poonamallee	761
Tirupathur	752
Ramanathapuram	735
Thoothukudi	732
Tirunelveli	722
Kovilpatti	675
Tenkasi	671
Namakkal	671
The Nilgiris	658
Thanjavur	646
Kallakurichi	627
Theni	625
Athur	602
Aranthangi	563
Pudukottai	559
Villupuram	465
Kanniyakumari	457
Madurai	450
Krishnagiri	441
Sivakasi	427
Kancheepuram	348
Chengalpattu	335
Perambalur	206
Chennai	153
State	758

The average number of beneficiaries per month per team of the districts ranges from 10 to 177 beneficiaries. Top 10 districts is given in Table 2.

Table 2: Team-wise average coverage of physiotherapy services under Makkalai Thedi Maruthuvam (MTM) Scheme, Aug 2021 to May 2024, Tamil Nadu

Name of the Health Unit Districts	Average number of beneficiaries per month per Block
Poonamallee	177
Ranipet	121
Ariyalur	99
Dindigul	93
Coimbatore	78
Karur	75
Tiruppur	69
Salem	64
Vellore	62
Thiruvannamalai	59

Among the diseases for which the physiotherapy services are provided, 17.3% were patients with Osteo / spondylo / Rheumatoid arthritis, followed by 17% patients with Chronic arthritis and 9.5% with hemiplegia. The other common diseases for which physiotherapy services provided is given in Figure 1
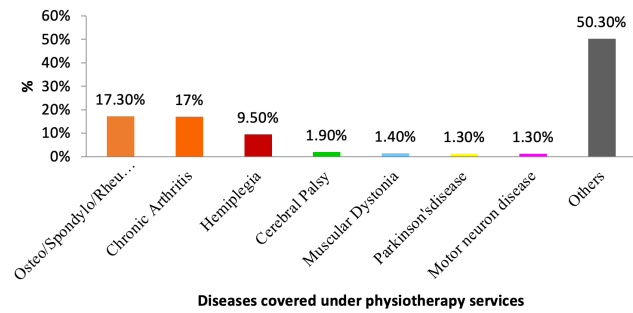

Figure 1: Diseases Covered under physiotherapy services in MTM scheme in Tamil Nadu

Those who are provided with physiotherapy services, 45% of the patients are currently under treatment, while treatment has been terminated for about 14.3% of beneficiaries. Of the total 11231 cerebral palsy patients given physiotherapy services, 1275 (11.4%) are in Madurai and 609 (5.4%) in Thiruvallur. Of the total 8307 muscular dystrophy patients given physiotherapy services, 1060 (12.8%) are in Madurai and 1002 (12.1%) in Thiruvallur.

DISCUSSION

The main findings of this study were that the majority of the patients who availed of home-based physiotherapy care services under the Makkalai Thedi Maruthuvam scheme are those with arthritis especially Osteo Arthritis (OA). Physical therapy is the recommended non-surgical approach for knee OA. Physiotherapy has been shown to not only help alleviate pain, but also enhance function, muscle strength, range of motion (ROM), joint stability, and aerobic conditioning.[6,7,8] Knee osteoarthritis (OA) is a primary cause of musculoskeletal disability in the elderly, impacting both men and women[9,10,11] according to the global burden of disease by WHO.[12]

Knee osteoarthritis (OA) doesn't just cause pain and joint stiffness, but also leads to reduced quadriceps strength, and physical disability, and affects overall disease outcome and quality of life.[13,14,15,16] In managing knee OA, the main goals of treatment are pain reduction and functional improvement. Combinations of interventions are often preferred over a single approach.[17] Moreover, research indicates that physical therapy, including exercise, can diminish the necessity for pharmaceutical and surgical treatments.[6] Physical exercise is a versatile activity that can be conducted both in a clinical setting and within the comfort of one's own home. Extensive documentation by Deyle[6] and Thomas et al.[18] underscores the clear and considerable advantages of engaging in home-based physiotherapy. Home-based physiotherapy presents numerous advantages for patients in need of rehabilitation.

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Providing care in the comfort of their own homes not only fosters independence and imparts valuable self-management skills, but also empowers patients to take control of their recovery journey. These services involve regular visits from healthcare professionals, ensuring consistent monitoring and follow-ups, which ultimately lead to improved continuity of patient care and heightened levels of satisfaction.[19,20]

The home-based physiotherapy services under Makkalai Thedi Maruthuvam also cater to individuals with neurological disorders, including conditions like hemiplegia which stands next to arthritis. Within this context, physical therapy for neurological patients encompasses a holistic approach aimed at educating and guiding patients to promote brain plasticity. By doing so, it helps to safeguard the functionality of the brain, muscles, and neuromuscular system, all of which are essential for maintaining overall health and a high quality of life.[21,22,23]

Treatment adherence is crucial for its success. Patients who follow their treatment plans tend to have better outcomes. In physiotherapy, adherence involves attending appointments, following advice, doing prescribed exercises correctly and consistently, and sticking to the recommended frequency and intensity of exercises.[24,25,26]

Home-based physiotherapy programs offer individuals the chance to carry on with therapy, whether it's in between center-based sessions or after completing center-based therapy. This allows for the continued maintenance of established intervention effects.[27,28]

The implementation of home-based physiotherapy programs creates opportunities for increased parental or caregiver involvement and empowerment. These programs foster an environment where parents and health professionals can learn from each other and gain insight into each other's perspectives on rehabilitation. Additionally, home-based physiotherapy programs are often seen as a cost-effective solution and can be the preferred or only viable option in certain situations, such as when patients live far away from healthcare institutions.[29,30,31]

Home-based physiotherapy simplifies treatment by eliminating the need to travel, reducing stress and dependency. It provides personalized, one-on-one care for seniors, reducing the risk of falls and supporting pain management, rehabilitation, and chronic condition management. These sessions play a crucial role in helping the elderly maintain independence and improve their mobility and functional ability.[32]

As the program continues to attract widespread attention and engagement from the public, the demand for it will rise. Consequently, it will be necessary to enhance and upgrade the system to effectively address future requirements.

CONCLUSION

Physiotherapy at home provides a holistic and patient-centred approach to care that enhances the individual's quality of life, promotes independence, and addresses specific needs and concerns; all within the comfort of their own home. The present study provides a descriptive picture of the overall coverage of physiotherapy services provided in all HUDs under the Makkalai Thedi Maruthuvam scheme. The long-term outcome of the home-based physiotherapy service is to be assessed in the future to understand the effectiveness and impact of improving the quality of life among the beneficiaries under this scheme. It will also help in identifying the key promoters and barriers for these services at the ground level in detail.

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ORIGINAL ARTICLE - PUBLIC HEALTH

RETROSPECTIVE STUDY ON THE CYCLIC OCCURRENCE OF DENGUE FEVER CASES (2012 - 2023) IN MADURAI DISTRICT, AN ENDEMIC AREA IN TAMIL NADU, INDIA

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Abstract

INTRODUCTION : Dengue Fever (DF) has become a serious public health problem in India during the past few decades and several outbreaks have been reported in many parts of the country. The problem of dengue, once confined to urban areas only, has now penetrated in rural areas also due to rapid urbanisation, implementation of several development schemes. In Tamil Nadu, an effective surveillance system has been established in recent years to prevent outbreaks. However, there is a paucity of information on the cyclical occurrence of dengue fever in a geographical area which is essential for forecasting any possible outbreak. Further, Epidemiological findings such as Attack Rate of dengue cases will provide reliable estimate of disease burden of an area so as to evolve appropriate strategies spatially and temporally in a geographical area. Therefore, a retrospective study on cyclic occurrence of dengue in Tamil Nadu from 2012 – 2023 is documented in order to implement appropriate control measures to prevent any possible major outbreak in Madurai district, Tamil Nadu.

OBJECTIVES : It is aimed to find out the spatial and temporal distribution of dengue fever cases in Madurai District, Tamil Nadu from 2012-2013 (12 Years), to analyse the effectiveness of Fever surveillance system an unique system followed in Tamil Nadu, to find out the Attack Rate of dengue cases in rural and urban areas for 12 years and to study the cyclic occurrence of cases and to recommend appropriate control measures.

METHODOLOGY : The effectiveness of the Fever surveillance system in Madurai District is analysed and documented in this article. Dengue cases confirmed serologically were considered for case incidence and calculating Attack Rate per 1 Lakh population in both Rural and Urban areas of Madurai district from 2012-2023. Month wise and Year wise occurrence of dengue cases in relation to rainfall and age wise and sex wise analyses have been done. Mosquito vector surveillance and vector control strategies adopted in in Madurai district is documented.

RESULTS : Fever surveillance and dengue testing in Madurai district revealed that there is a definite cyclic pattern in dengue occurrence once in 5 6 years in both rural and urban areas in Madurai District. Further, the active transmission season of dengue is from June to December every year with a peak after Northeast Monsoon period in October confirming the positive correlation with rainfall. In all the 12 years, it is found that more number of males and adults have been affected with dengue than females and children (less than 12 years). Vector surveillance and control involving line departments like local bodies and creation of awareness on dengue control among people have provided good results.

CONCLUSION : It is evident from this study that the Fever surveillance system existing at present is very effective and it provides reliable estimate of disease burden. It is confirmed that Dengue epidemic cycle is established once in 5 years in Madurai district. Further, the active transmission season is from June to December following monsoon period which necessitates the Public Health system to be alert in case management and vector control in time to prevent any possible dengue outbreak in Madurai district.

KEYWORDS : Dengue Fever, Epidemic Cycle, Seasonal occurrence of Dengue, Aedes aegypti mosquitoes

INTRODUCTION

Dengue is a rapidly expanding mosquito-borne virus infection in tropical and subtropical climates. It is endemic in more than 100 countries, and about 400 million people are infected with dengue fever annually. In India, Dengue Fever has become a significant public health problem in many parts of the country in recent years. Dengue fever surveillance and mosquito control activities are implemented through various health programs in India to reduce the disease burden and dengue related deaths. Since the dengue vaccine has not yet been developed, various vector control strategies are being implemented intensively. In recent decades, due to climate change and global warming, the density of mosquitoes, population dynamics, disease transmission potential,

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etc., have tremendously altered. Further, due to rapid urbanization, the implementation of various development schemes, industrial developments, and the construction of dams, the breeding grounds of mosquitoes have enormously increased in both rural and urban areas. The public health interventions now adopted for mosquito control involve anti-larval and anti-adult measures, which require high inputs of insecticides and manpower. Since the mosquitogenic conditions in and around human habitations are man-made problems, and because of the diverse breeding sites of Aedes aegypti mosquitoes, it is felt essential to evolve community-based strategies for mosquito control to reduce the disease burden.

In India, several outbreaks of dengue fever have been reported since 1912, when an outbreak of dengue fever was reported in Kolkata.[1] In south India, all four serotypes of dengue virus were first isolated from febrile patients in Vellore, Tamil Nadu, between 1956 and 19662.[3] During the same period, dengue virus isolations were made in wild caught Aedes aegypti mosquitoes[4,5] confirming the activity of different serotypes in Tamil Nadu as early as the 1960s. However, until 1990, no major outbreak of dengue/dengue haemorrhagic fever (DF/DHF) was reported in Tamil Nadu. Epidemics of DF/DHF that were reported after 1990 were confined to some regions of Tamil Nadu.[6-9]

In Tamil Nadu, several dengue fever outbreaks have been reported during the last two decades, and a detailed study on the spatial and temporal incidence of dengue cases has already been documented from 1998 to 200610. However, the dengue fever outbreaks that occurred in Madurai district during 2012 necessitated the Tamil Nadu Public Health Department for the establishment of a daily fever surveillance system, the networking of laboratories, the involvement of various line departments in dengue control activities, and community – based vector control strategies. It is imperative to analyze the data on the dengue fever incidence during the last 12 years in Madurai district to understand the distribution of cases in various geographical areas during different seasons of the year in order to implement appropriate vector control activities in time, thereby preventing significant outbreaks of dengue.

Therefore, this article aims to find out the temporal and spatial occurrence of dengue fever cases in Madurai district, Tamil Nadu, during the last 12 years (from 2012 to 2023), to analyse the establishment of a Fever surveillance system in Madurai district and its effectiveness in disease monitoring and control activities, to find out the Attack Rate of dengue cases in rural and urban areas for the last 12 years

in Madurai district to assess the burden of the disease, to determine the impact of vector control activities on dengue case incidence in rural and urban areas and to identify the significant factors responsible for the occurrence of dengue cases in Madurai district during the study period.

METHODOLOGY

Study Area : Dengue fever surveillance and vector control activities are carried out routinely in both rural and urban areas of Madurai district, Tamil Nadu. Madurai district is one of the central districts in south Tamil Nadu, and there is a frequent migration of people from neighboring districts for various purposes, including attending to health care facilities for various illnesses. Madurai district (3741.73 km2 area) is located in North Latitude between 9°30' 00'' and 10°30'00'' and East Longitude between 77°00'00'' and 78°30'00'' with a population of 30,38,252 (Rural 1191451 and Urban 1846801). Madurai district includes one corporation with 100 wards, 3 municipalities, and 13 blocks with 9 town panchayats and 420 village panchayats.

A retrospective study on dengue incidence in Madurai district was carried out, and secondary data was collected from the District Health Office at Madurai. The networking of the fever surveillance system and vector control activities followed in Madurai district are documented in this article.

Fever/Dengue Surveillance system in Madurai District :
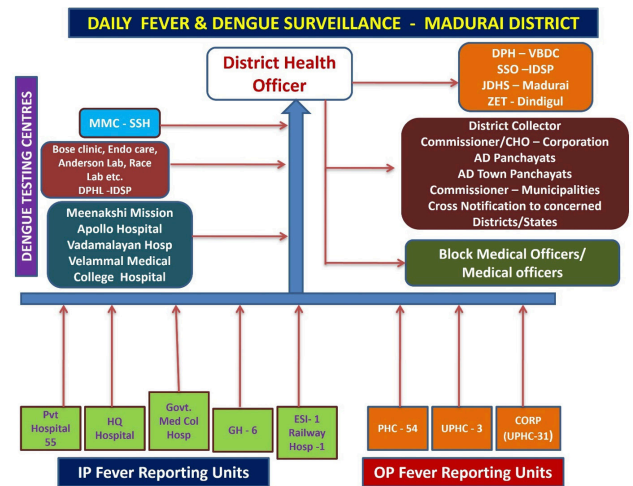

Figure 1: Fever/Dengue Surveillance system in Madurai

Prior to 2012, there was no networking of hospitals for daily fever surveillance, and the experience learned from the 2012 outbreak necessitated establishing a well-organized fever surveillance system in Tamil Nadu. Dedicated health inspectors have been deployed to all surveillance hospitals,

and data from 8.00 a.m. to 8.00 a.m. (24 hours) on a daily basis regarding the admission and discharge of fever cases and dengue cases within the last 24 hours has been collected. Thus, a total of 53 private hospitals and 10 government hospitals, including Madurai Medical College hospital, are included in the daily surveillance network in Madurai district (Figure 1). Similarly, major dengue testing laboratories in Madurai district are also included in the reporting system, and a line list of dengue positive cases is received on a daily basis. The data thus collected from surveillance hospitals and dengue testing centers are communicated to the respective peripheral health facilities and the stakeholders to take appropriate control measures immediately in the field. The District Health Officer, Madurai District, acts as a nodal officer who communicates information on dengue incidence and monitors control activities in the district.

Further, the data on the dengue cases in other districts was communicated to the districts concerned and the Directorate on a daily basis. this system has paved the way to work in coordination with all line departments, such as municipal corporation, municipalities, rural development department, town panchayats, all block level health facilities, education, ICDS, etc., Further, daily OP fever surveillance system has been established in all primary health centres in Rural Areas and Urban Primary Health Centres in corporation and municipalities and this enables the health authorities at the PHC level to take immediate intervention measures in the village/ward/street reporting fever cases continuously and to attend any area with an unusual occurrence of fever cases immediately. The flow of information at various levels is shown in Figure 1.

Dengue testing and Laboratory Network : The serological diagnosis of dengue viral infections in the Institute of Microbiology, Government Medical College Hospital (Govt Rajaji Hospital), Madurai, was carried out using the NIV IgM ELISA kit and designated as Sentinel Surveillance Hospital for dengue diagnosis. Further, in the private hospitals, dengue testing laboratories, and District Public Health Laboratory under IDSP, dengue diagnosis was done using either IgM ELISA, NS1 antigen detection ELISA, or Rapid Diagnostic Test kits that are commercially available. However, the data on the results of laboratory testing centers were collected on daily basis (8.00 a.m. to 8.00 a.m.) and communicated to the various levels online for taking the necessary interventions to interrupt dengue transmission. Thus, ten dengue testing laboratories were included in the dengue surveillance network in Madurai district.

For vector control activities, dedicated, well trained manpower designated as Domestic Breeding Checkers (DBCs) are involved in fever/dengue case reported areas. For engaging DBCs and supervising their activities related to dengue control, the intersectoral coordination with line departments such as Rural Development, Town Panchayats, Urban Local Bodies etc., is well established with a network of various staff in each department.

Data analysis : Data on the dengue case incidence for 12 years (from 2012 to 2023) were analyzed year-wise by calculating the Attack Rate / 1 Lakh population for rural areas, municipalities, and corporation and the month-wise incidence of dengue cases was also analyzed to find out the seasonal occurrence of dengue cases. Further, age-wise and sex-wise analyses of dengue cases have been done to find out the male-to-female ratio in dengue incidence and to find out whether children or adults were affected more in numbers during the study period.

RESULTS

It is obviously known that disease surveillance plays a vital role in the Public Health Care system to identify the geographical area where the disease occurrence is high, which age group is affected, and during which season the disease occurs, which enables the program implementors to act rapidly to prevent any major outbreaks. In Tamil Nadu, dengue fever outbreaks were reported in various districts, resulting in a sizeable number of dengue-related deaths during 2012. Madurai is one of the various districts where 2364 cases were reported during this period.

Dengue incidence in Madurai District from 2012 to 2023 :
Laboratory-confirmed dengue-positive cases (either by Dengue IgM ELISA, NS1 antigen ELISA, or Rapid Diagnostic Test kit) are included in the study from 2012 to 2023. Attack Rate (AR) per 1 lakh population was calculated for laboratory confirmed cases year-wise and area-wise and it was found that dengue case incidence was high during 2012 (Attack Rate 77.14), 2017 (Attack Rate 125.69), and 2023 (Attack Rate 63.0), as shown in Figure 2. Further, the analysis of the geographical distribution of cases in Madurai district revealed that dengue case incidence in rural and urban areas (Municipalities & Corporation) also showed a similar trend with high incidence during 2012, 2017, and 2023, as shown in Figure 3. Data analyzed for all blocks which included Town Panchayats and Village Panchayats separately year-wise, it was found that all blocks, showed the same trend in dengue

case incidence from 2012 to 2023, with peaks in 2012, 2017, and 2023. Similarly, the data for all 3 municipalities and Madurai Corporation, when analyzed separately, showed a similar trend in dengue case incidence in Madurai district.
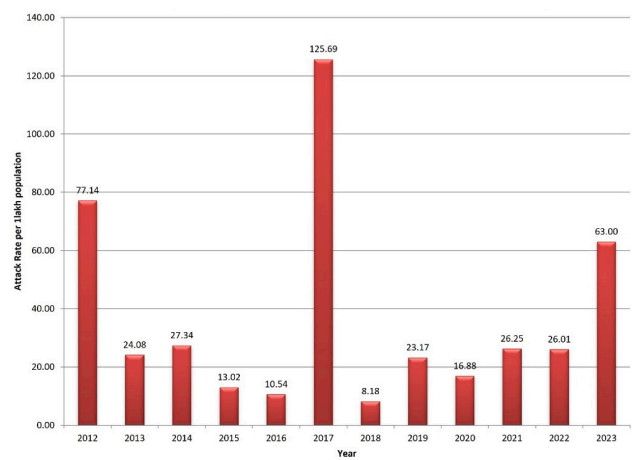

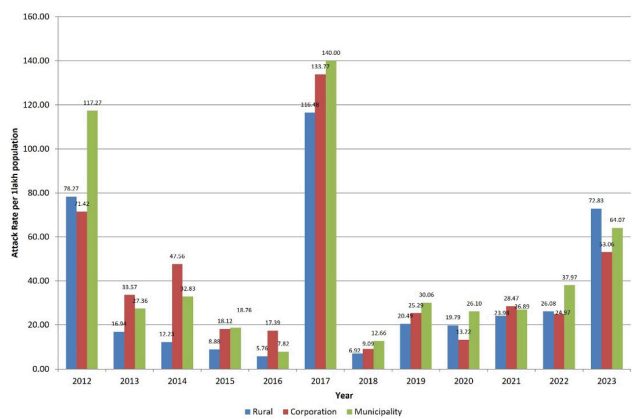*Figure 2: Attack Rate of Dengue Cases - 2012 - 2023 - Madras District*

Figure 3: Area wise - Attack Rate of Dengue Cases - 2021 to 2023 Madurai District

Age wise analysis of dengue cases in Madurai district was done from 2013 to 2023, which showed that more dengue cases were reported in adults (above 12 years) than children (less than 12 years) in all years (Table 1 and Figure 4). Similarly, gender-wise analysis revealed that more males were infected with dengue infections than females (Table 1 and Figure 5) in all years. Thus, the male-female ratio for the study period with regard to dengue case incidence was found to be 1.15:1 in Madurai district.

Table 1: Age wise and Sex wise Percentage of Dengue in Madurai District (2013 to 2023)

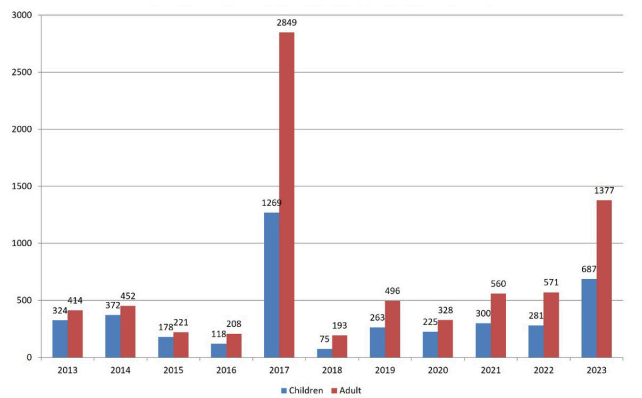| Year	Male	Female	<=12 (Children)	>12 (Adults)
2013	54.2	45.8	43.9	56.1
2014	54.9	45.1	45.1	54.9
2015	56.4	43.6	44.6	55.4
2016	47.2	52.8	36.2	63.8
2017	51.4	48.6	30.8	69.2
2018	52.6	47.4	28.0	72.0
2019	55.1	44.9	34.7	65.3
2020	56.8	43.2	40.7	59.3
2021	56.0	44.0	34.9	65.1
2022	53.5	46.5	33.0	67.0
2023	55.8	44.2	33.3	66.7
TOTAL	**53.7**	**46.3**	**34.8**	**65.2**

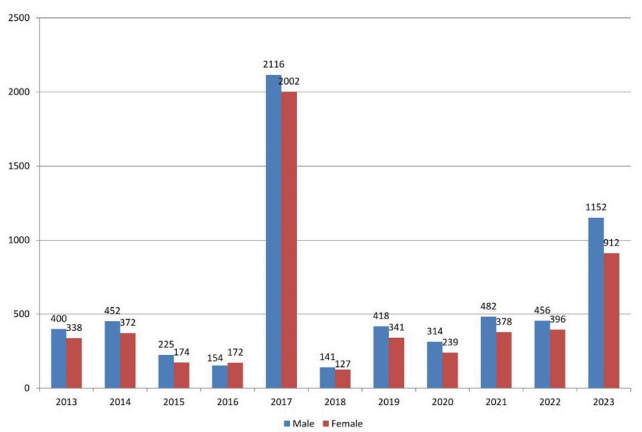*Figure 4: Age wise Dengue Cases in Madurai District (2013 to 2023)*

Figure 5: Sex wise Dengue Cases in Madurai District (2013 to 2023)

Seasonal occurrences of dengue cases were analyzed month-wise and year-wise from 2013 to 2023 (month-wise data is unavailable for 2012). Rainfall data collected from the District Statistical Office in Madurai showed that Madurai district receives more rainfall during the northeast monsoon period (October to December) than the southwest monsoon

period (June to July), as shown in Figure 6. It was observed that month-wise and year-wise dengue case incidence increased from June to December every year (Figure 7).

Further, when data on dengue cases were analyzed separately for urban (Figure 8) and rural (Figure 9) areas for the study period, the same trend was observed.
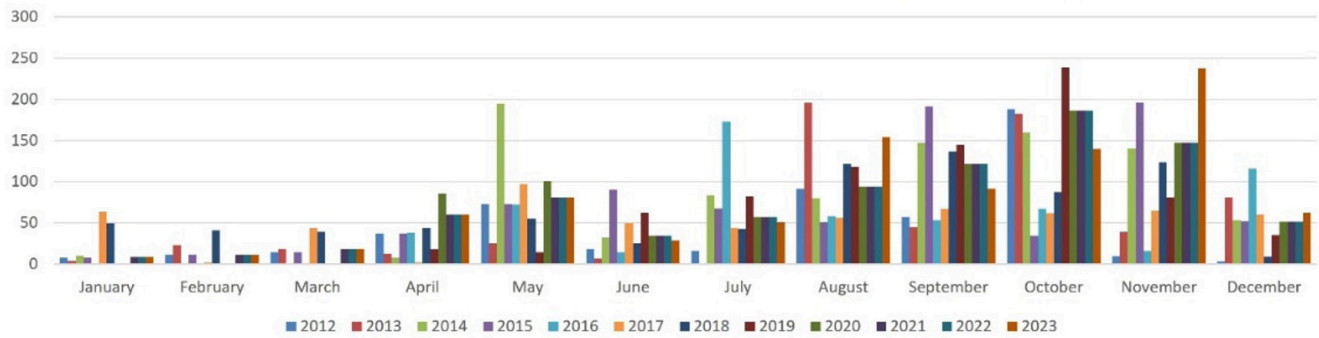

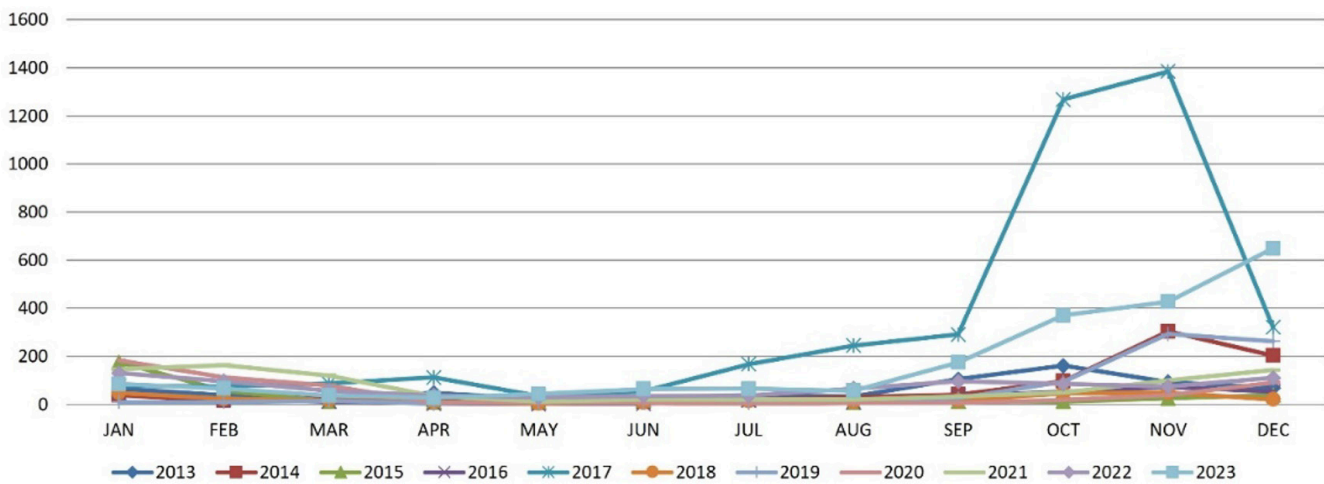*Figure 6: Month wise rainfall Recorded in Madurai District (2012 - 2023)*

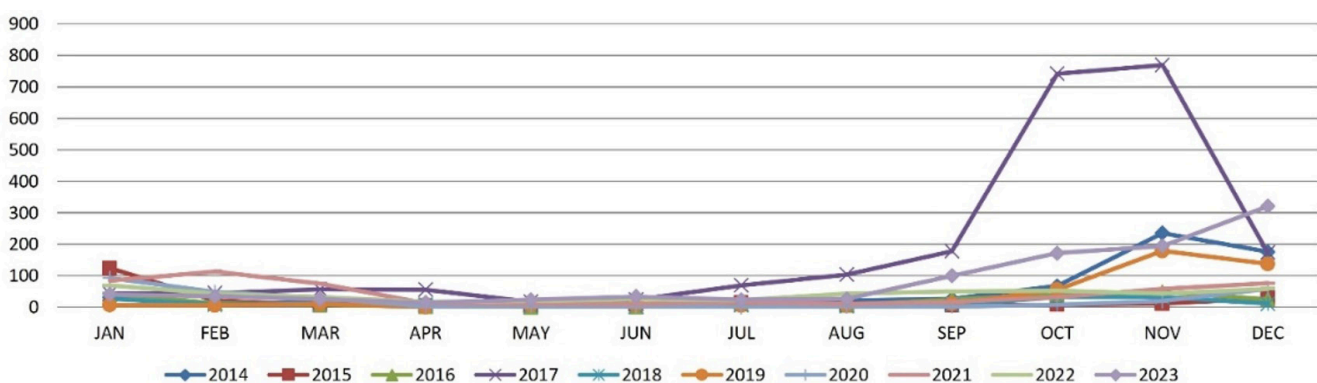*Figure 7: Month and Year wise incidence of Dengue Cases - 2013 to 2023 - Madurai District*

Figure 8: Month and Year wise incidence of Dengue Cases - 2014 to 2023 - Madurai District (Urban Area)
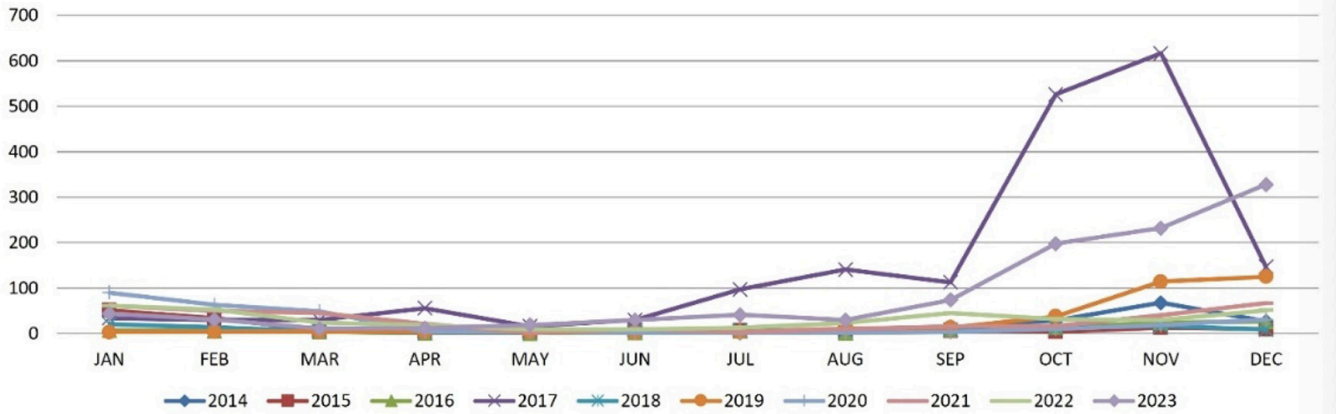
Figure 9: Month and Year wise incidence of Dengue Cases - 2014 to 2023 - Madurai District (Urban Area)

Dengue Vector Surveillance and Control :

It is well known that Aedes aegypti mosquitoes transmit dengue virus, and this mosquito breeds in clean water storage containers, drums, barrels, discarded containers, refrigerators, air coolers, etc. Prior to 2012, an adequate number of dengue control workers (DBCs) were not engaged in dengue control activities. However, after the 2012 dengue outbreak, due to inter departmental coordination in dengue control activities and understanding the need for increasing the work force in dengue control, 20 DBCs in each block, 10 DBCs in each Town Panchayat and the number of DBCs as per Plan 300 in Municipalities and Corporations were engaged in Madurai district. The network of Dengue Vector Surveillance and Control and the various departments and staff involved are shown in Figure 10. The areas with dengue case incidence and high Aedes larval density were prioritized for dengue control activities.
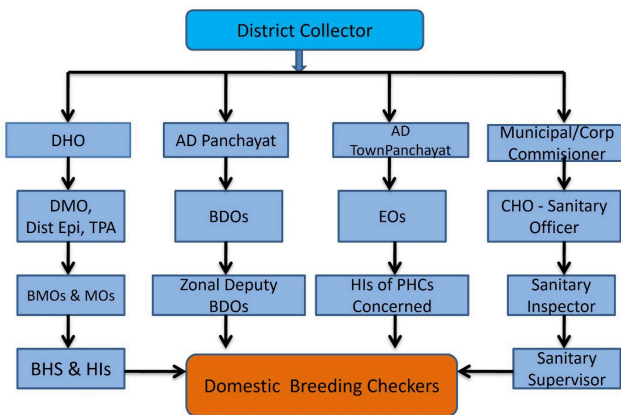

Figure 10: Dengue Vector Surveillance & Control - Madurasi District

Temephos 50% EC is the larvicide used for the control of immatures at a recommended dose. During the study period, Standard Aedes larval indices were calculated to assess the intensity of breeding in an area and the type of larval breeding sites found to vary from area to area. Based on the available major breeding sources in an area, appropriate control measures were taken. However, source reduction was given priority in dengue vector control activities, and the elimination of breeding sites by DBCs under the supervision of the health inspectors was carried out intensively. Indoor thermal fogging was carried out in the areas using Pyrethrum 2% extract in hand-operated fogging machines. Fogging was preferred in the areas where dengue positive cases were reported and the areas found to have a high density of Aedes mosquitoes. In Madurai district, all three commonly prevalent aedine species, viz., Aedes aegypti, Ae. albopictus, and Ae. vittatus were collected. However, Ae.aegypti, the principal vector of dengue, was found to be the most prevalent species in Madurai district in both rural and urban areas.

DISCUSSION

Madurai district is one of the major cities in southern Tamil Nadu, where people from other districts visit the city for various purposes like occupation, pilgrimage, and accessing health care facilities. It has been observed for a long time that outbreaks of communicable diseases such as Hepatitis, Leptospirosis, and water-borne and vector-borne infections have occurred on several occasions in both rural and urban areas. Prior to 2012, there were sporadic occurrences of dengue cases in Madurai district, and after the development of diagnostic facilities in Madurai district, few outbreaks of dengue fever have been reported. However, the outbreak occurred during the year 2012 in urban and rural areas in Madurai district, necessitating the development of an organized and systematic surveillance system involving

all government and private hospitals where the fever cases are admitted. Subsequently, the diagnostic facilities were made available in Government Medical College Hospital and Private Hospitals paving the way for identifying the geographical areas with the highest prevalence of dengue cases and the timely management of severe dengue cases in hospitals following standard treatment protocols.

The IP Fever/Dengue surveillance system on a daily basis in all health care facilities has helped in the timely implementation of intervention measures like fever control activities and vector control strategies through Primary Health Care network involving the line departments. Hence, the number of outbreaks reported in Madurai district in recent years has drastically reduced, and at the same time, the surveillance system and vector control have also been strengthened in Madurai district.

It is obviously known that the circulation of multiple serotypes and genotypes of dengue viruses in the community favors the occurrence of Dengue Haemorrhagic Fever (DHF), a severe form of dengue fever that requires immediate medical attention. A study on molecular analysis of dengue virus serotypes circulating in Chennai, Tamil Nadu, revealed that the samples tested were positive for dengue 2 virus and dengue 3 virus during 2013 – 2015[11] and it was found that the Dengue virus-3 serotype belonged to genotype III and clustered with Delhi and Gwalior sequences. Similarly, another study conducted in 2007 in O.Alangulam village in a rural area of Madurai district, Tamil Nadu, also showed that the sample tested was positive for Dengue 3 serotype, and phylogenetic analysis revealed that it was closely related to the Delhi-12 and Gwalior-25 isolates[12]. The authors have concluded that the Dengue 3 virus might have invaded this area through a North Indian traveler infected with this dengue virus to the airport which is geographically closer to the village. These findings made during dengue outbreaks may be useful in the documentation of the prevalence of different serotypes and genotypes that are circulating in the community. However, the detection of dengue virus infections in mosquitoes will be very helpful in forecasting possible outbreaks and can be considered an essential tool for epidemiological surveillance.

The Cyclical occurrence of dengue has been established in the present study. Further studies are needed to analyze various factors, including the invasion of new serotypes and Genotypes in the community as reported in other areas, so as to develop newer strategies for dengue control.

Several studies in Tamil Nadu have documented the presence of all four serotypes of dengue viruses in Ae. aegypti mosquitoes since 1960s[4,5,8,13] and vertical transmission of dengue virus in Ae. aegypti mosquitoes has been confirmed in wild caught mosquitoes in Tamil Nadu, confirming that the dengue virus is maintained in nature during the inter-epidemic period.[14] Therefore, it is understood that there is a need for an effective surveillance system to find out dengue virus infections in mosquitoes to forecast outbreaks in Tamil Nadu. However, the epidemiological significance of the vertical transmission of dengue virus in Aedes mosquitoes in the occurrence of clinical cases of dengue fever needs to be studied in detail.

In the present study, it was observed that the dengue cases increased from June onwards, and the cases peaked during October and November following the monsoon period. Similar trend in Tamil Nadu has already been documented from 1998 to 2006, where dengue cases increased from June to December, confirming the active transmission period was during the monsoon and post monsoon period.[10]

Entomological surveillance carried out in the study area during 2012 -2023 has revealed that Aedes aegypti is the most prevalent dengue vector in Madurai district. The Aedes larval survey carried out in both rural and urban areas showed that peri-domestic water holding containers provided major breeding sites for Aedes mosquitoes during monsoon and postmonsoon periods. But during the summer season, water storage practices of people due to scarcity of water, resulted in high breeding of Aedes mosquitoes. However, the type of breeding habitat varies from one area to another. For instance, during 2012, a higher number of cases were reported in rural and urban areas of Melur block. In this area, the Ground Level Reservoir (GLR) and the pit taps acted as potential breeding sites for dengue vectors. Similarly, in the Corporation area, the water storage containers provided breeding grounds for Aedes mosquitoes. Hence, it is suggested that the anti-larval activities be formulated as per the types of breeding sites available in an area.

The results of the present study show that there is a definite pattern of epidemic cycle in the occurrence of dengue cases, and it is found that once every 5 to 6 years, there is an epidemic form of dengue in Madurai district. A study conducted in Singapore from 2004 to 2016 revealed that the dengue epidemic pattern followed once every three years, and in each epidemic cycle, dengue cases peaked during the traditional dengue transmission season from June to September.[15] However, there are reports that emphasize that the changing pattern of circulating serotypes and genotypes during epidemics needs to be known to understand the

severity of the cases occurring in an area.[11]

Dengue cases were reported in greater numbers in males than females from 2013 to 2023 in Madurai district, and the male: female ratio was found to be 1.5:1. Similar observations were made in several studies conducted in Tamil Nadu[12] and in Kolkatta16 India, in Saudi Arabia[17] and in Singapore[15] where more number of dengue cases were reported in males than females, whereas male:female ratio was 1:1 in Argentina18 and it was observed 1:4 in Karachi, Pakistan, in 2006.[19] In the present study it was observed that dengue virus infections occurred more numbers in adults than Children in all the years under study. This is in conformity with the results observed in Malaysia[20], Argentina[18], Singapore[15] and in Kolkatta, India.[16]

CONCLUSION

Prior to 2012, dengue cases were reported sporadically in Madurai district, and the outbreak that occurred during 2012 necessitated the establishment of a routine surveillance system in the district. An unique Daily Fever surveillance system followed in Tamil Nadu involving sentinel centers involving Government and Private Hospitals has paved the way for identifying the areas with clustering of cases and is also useful in the implementation of appropriate control measures in coordination with the line departments in Madurai district. It is evident from the present study that there is a definite pattern of epidemic cycle in the occurrence of dengue fever once every 5 years in Madurai district, Tamil Nadu, which emphasizes the need for preparedness to implement appropriate control measures in the vulnerable areas in both urban and rural areas.

It is also observed that dengue cases occur in greater numbers from June to December, indicating that monsoon and postmonsoon periods are the active transmission periods because of the increased breeding sources available for Aedes aegypti mosquitoes in peri-domestic areas. However, it is noticed that the larval density is high indoors during the summer season since people tend to store water for more than a week. These results are in conformity with the results of the studies conducted in Tamil Nadu from 1998 to 200610. Therefore, it is concluded that the transmission of dengue occurred in large numbers from June to December as evidenced from the data available from 1998 to 2023 (26 years of data). Further, the dengue Attack Rate in all 12 years under study revealed that both rural and urban areas followed a similar trend in all these years. The spatial distribution of cases shows that all rural and urban areas are affected with dengue cases sporadically. Systematic planning

and execution control activities utilizing available Domestic Breeding Checkers throughout the year have resulted in preventing many outbreaks in Madurai District.

Earlier investigations conducted during an outbreak in Madurai district revealed that the Dengue -3 serotype is circulating in certain rural areas of the district12. It indicates the circulation of multiple serotypes and genotypes in the community. Further longitudinal studies are to be carried out to explore the occurrence or invasion of new serotypes or genotypes in the community in various seasons to map out the areas with a prevalence of various serotypes in Madurai district. Since, no vaccine is available for dengue control, the only possible way is vector control. Aedes aegypti, the principal vector of dengue fever, is the most abundant species in all areas, and the breeding sites vary from area to area. Therefore, appropriate control measures, such as source reduction and the application of larvicides, should be selected based on the availability of potential breeding sites. Vertical transmission of dengue virus has already been established in Tamil Nadu, and the virus is maintained in inter-epidemic periods, which favors the silent transmission of dengue virus in the community13. Dengue viral infection in vector mosquitoes, an essential tool for epidemiological surveillance, should be further strengthened with standard protocols so as to forecast any possible DF/DHF outbreaks in Tamil Nadu.

ACKNOWLEDGEMENTS

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ORIGINAL ARTICLE - PUBLIC HEALTH

IDHAYAM KAAPOM THITTAM (IKT) – A GOVERNMENT OF TAMILNADU INITIATIVE TO PREVENT DEATH DUE TO CARDIAC ILLNESS - A DESCRIPTIVE STUDY

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Abstract

INTRODUCTION : Chest pain is a common reason for primary care visits. About 4–7% of chest pain cases are due to acute coronary syndrome (ACS). Timely identification and management of suspected ACS in primary care should include determining the need for referral. Prompt screening, early identification of true cases and prompt management, especially with thrombolytic and aspirins with timely referral in "GOLDEN HOUR", the first 60 min of a heart attack is, of utmost importance. The Tamil Nadu government has initiated a cardiac care program called 'Idhayam Kaapom Thittam' to prevent sudden deaths due to cardiac illness.

OBJECTIVE : To understand the health profile of the beneficiaries under Idhayam Kaapom Thittam and their status of co-morbid conditions based on State data collected from June 2023 to May 2024.

METHODOLOGY : A descriptive study was done based on the secondary data analysis of the beneficiaries of the 'Idhayam Kaapom Thittam' Programme available in the State Data for the period from June 2023 to May 2024 across all districts of Tamil Nadu. Patients showing symptoms of acute coronary syndrome at primary health centres will receive ECG services, Cardiac emergency loading dose of drugs – Aspirin, Clopidogrel, and Atorvastatin, and followed by referrals to secondary or tertiary care facilities for further cardiac evaluation and assessment

RESULTS : Out of a total of 6090 beneficiaries under this scheme who were provided with cardiac emergency loading dose, 953(16%) were subjected for further evaluation and definite cardiac intervention done. Of them, 56% underwent angiography, 39% underwent thrombolysis, 23% had stenting done, 8% of them went for CABG.

CONCLUSION : Given the increase in non-communicable diseases and cardiac-related deaths, this program serves as a model initiative aimed at addressing the mortality and morbidity associated with cardiac illness, as well as improving the quality of life for every individual in Tamil Nadu.

KEYWORDS : Cardiovascular diseases, Sudden Cardiac Illness, Golden Hour

INTRODUCTION

Non-Communicable Diseases (NCDs) contribute to nearly two-thirds of the total burden of diseases in India. Cardiovascular diseases (CVDs) account for nearly half of total NCD deaths and around 28% of all deaths in the country.[1] This epidemiological transition is largely because of the increase in the prevalence of CVDs and CVD risk factors in India1. One in 4 deaths in India are now because of CVDs with ischemic heart disease and stroke responsible for >80% of this burden.[2] These diseases tend to affect patients in the most productive years of their lives and result in catastrophic social and economic consequences. By 2025, India is predicted to have the highest incidence of diabetes & heart diseases in the world & CVD will be the leading cause of death & disability in India.

CVDs and NCDs are at times incorrectly considered urban phenomena. Recent, epidemiological studies have found that the prevalence of risk factors and disease burden of NCDs and CVDs in rural areas is only marginally lower than the urban settings and is increasing at a rapid pace. This situation has evolved alongside a better scientific understanding of the risk factors for NCDs and CVDs, providing opportunities to develop, design, and implement a range of health interventions.

Chest pain is a common reason for consultation in primary care.[1,2] In 4%–7% of patients presenting with chest pain, the pain is caused by acute coronary syndrome (ACS).[1-3] Early identification and treatment of patients with ACS are important to avoid cardiac morbidity and mortality. The assessment and management of patients with suspected ACS in the primary care setting should include determining the urgency of the need for referral. If patients have had any ongoing symptoms within the preceding 24 hours, they should be referred immediately to an emergency department for assessment. An ECG should be performed immediately after assessing the patient with suspected ACS

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for identification of ST-elevation myocardial infarction (STEMI). However, it is to be noted that the 12-lead ECG has limited sensitivity in identifying MI without ST- elevation and >30% of the patients with non-ST-elevation myocardial infarction (NSTEMI) have a normal ECG.[11]

Considering the silent progression of the disease and the requirement of specific expertise for diagnosis and treatment, early diagnosis and treatment facilities are extremely limited at Primary Health Centres (PHCs). Prompt screening, early identification of true cases and prompt management, especially with thrombolytic and aspirins with timely referral in "GOLDEN HOUR", the first 60 min of a heart attack is, of utmost importance.

Patients reporting to the Primary Health Centres (PHCs)/ Health sub-centres (HSCs) with symptoms of acute coronary syndrome will be referred for ECG service and on consultation with the district nodal cardiologist, Emergency cardiac loading dose drugs containing Aspirin 150mg - 2, Clopidogrel 75mg - 4, and Atorvastatin 10mg - 8, a total of 14 tablets will be provided and referred to secondary/ tertiary care facilities for further management. This study aims to provide an overview of "Idhayam Kaapom Thittam" in Tamil Nadu. This study is conducted to understand the health profile of the beneficiaries under Idhayam Kaapom Thittam and their status of co-morbid conditions based on State data collected from June 2023 to May 2024.

The Government of Tamil Nadu has launched the 'Idhayam Kaapom Thittam' program to prevent deaths caused by cardiac illness. The program was launched in Tamil Nadu on June 27, 2023, at the Malumichampatty health sub-centre in the Madukkarai block by the Health and Family Welfare Department, as per the State Assembly announcement No:15 for the year 2023-24. The total project cost is 3.37 crores.

This study aims to provide an overview of the "Idhayam Kaapom Thittam" in Tamil Nadu. This study is conducted to understand the characteristics of the individuals benefitted under Idhayam Kaapom Thittam and their status of co-morbid conditions based on State data collected from June 2023 to May 2024 across Tamil Nadu.

RESULTS

A total of 6090 beneficiaries reported with symptoms of acute cardiac illness and were provided with cardiac loading dose drugs in the Primary Health Centre (PHCs) and Health Subcentres (HSCs). Of the 6090 individuals, 4007 (65.8%) were males and 2771 (45.5%) were between 45 to 60 years of age and 1395 (22.9%) were between 31-45 years of age. The age and gender distribution,

comorbidities of the beneficiaries are shown in Table 1. Of the patients with co-morbidities 47.6% of the patients had Hypertension, about 14% had diabetes and 11.6% had both diabetes and hypertension. Regarding personal habits, 18.9% were smokers and 19.7% were alcoholics.

Table 2: Characteristics of beneficiaries of the Idhayam Kappom Thittam, June 2023 to May 2024, Tamil Nadu (N=6090)

Category		Frequency	(%)
Gender	Female	2083	34.0
	Male	4007	66.0
Age Distribution	≤ 30 years	180	3.0
	31 – 45 years	1395	22.9
	45 – 60 years	2771	45.5
	≥61 years	1744	28.6
Comorbidities	No Comorbidities	1637	26.8
	Hypertension	2897	47.6
	Diabetes mellitus	851	14.0
	Both HT & DM	705	11.6
Risk factors	Smokers	1146	18.9
	Alcoholics	1197	19.7

Among all those patients who were given cardiac loading dose and subsequently referred, 98.7% had recovered upon further treatment while 1.3% of patients died. The distribution of individuals received emergency cardiac doses by Health Unit District wise is given in Table 2. Of the total beneficiaries, the highest contribution is from Nagapattinam and lowest from Poonamalle HUD.

Table 2: Health Unit District wise beneficiaries in Idhayam Kappom Thittam, June 2023 to May 2024, Tamil Nadu (N=6090)

Name of the Health Unit District	Frequency (n)	%
Nagapattinam	458	7.5
Chennai	359	5.9
Erode	285	4.7
Viluppuram	287	4.7
Coimbatore	281	4.6
Tiruppur	254	4.2
Cuddalore	211	3.5
Tiruchirappalli	210	3.5
Tirunelveli	212	3.5
Tenkasi	209	3.4
Dharmapuri	199	3.3
Sivaganga	197	3.2
Thoothukudi	169	2.8
Attur	167	2.7
Dindigul	152	2.5
Tiruvallur	154	2.5
The Nilgiris	148	2.4
Kallakurichi	131	2.1
Chengalpet	116	1.9
Kanchipuram	113	1.9
Mayiladuthurai	112	1.8

Perambalur	102	1.7
Kanyakumari	95	1.6
Theni	96	1.6
Salem	90	1.5
Thanjavur	88	1.5
Tiruvarur	94	1.5
Namakkal	85	1.4
Sivakasi	83	1.4
Tiruvannamalai	85	1.4
Vellore	85	1.4
Madurai	72	1.2
Paramakudi	72	1.2
Karur	69	1.1
Kovilpatti	64	1.1
Palani	69	1.1
Pudukkottai	64	1.1
Ramanathapuram	69	1.1
Ranipet	62	1.0
Ariyalur	56	0.9
Krishnagiri	49	0.8
Tirupattur	40	0.7
Virudhunagar	40	0.7
Aranthangi	17	0.3
Cheyyar	15	0.3
Poonamallee	4	0.1

Individuals given with the loading doses were referred to the higher centres for confirmation and further cardiac evaluation and management. Of those referred, 953 (16%) were subjected for further evaluation and definite cardiac intervention done. Of them, 56% underwent angiography, 39% underwent thrombolysis, 23% had stenting done, 8% of them went for CABG.

There is no significant association between the age, or gender of the patient and the outcome of the study population who were given cardiac loading doses at healthcare facilities (p value>0.05).

DISCUSSION

Early detection of acute cardiac illness and timely intervention among individuals presenting with chest pain and other symptoms of acute coronary syndrome especially among middle-aged adults will be considered as a significant achievement under this program. Rienna G. Russo et al. observed the mortality benefits from early aspirin use based on the relative reduction in mortality after 28 days of AMI from the International Study of Infarct Survival-2 trial.

The use of aspirin within 4 hours of symptom onset led to a 25% reduction in 28-day cardiovascular mortality and starting aspirin between 4 to 24 hours of symptom onset led to a 21% reduction in 28-day cardiovascular mortality compared with no use.[4] The early oral aspirin administration, including self-administration, appears to have a raised short- and long-term survival ratio as compared to the late administration of aspirin in subjects with non-traumatic chest pain typical of an acute MI.[5] The 2021 ACC/AHA/Society for Cardiovascular Angiography and Interventions guidelines for coronary artery revascularization recommended aspirin loading in patients before PCI, which is a COR I and LOE B-R based mainly on trials conducted in the 1980s and found a significant reduction in angiographic thrombus formation complicating the procedure aspirin use compared to no aspirin

Similarly, the use of clopidogrel benefitted many patients, including those who were undergoing revascularization procedures and those who were not. It was also observed that those at low, medium, and high risk of cardiovascular events and those who received several proven therapies such as aspirin, lipid-lowering drugs, angiotensin-converting–enzyme inhibitors, and beta-blockers benefitted.

It was concluded that clopidogrel was useful as early as the first 24 hours after randomization in the study indicating that the oral loading dose was rapidly effective and significantly reduced the risk of the composite outcome of death from cardiovascular causes, nonfatal myocardial infarction, or stroke, as well as a range of related ischemic events.[6-9]

In a study by Gregory G. Schwartz et. al, it was concluded that the early initiation of treatment with atorvastatin 80 mg/d within 24 to 96 hours after an Acute Coronary Syndrome had a 2.6% absolute reduction and a 16% relative reduction in the primary combined end point of death, nonfatal acute MI, cardiac arrest with resuscitation, or worsening symptomatic myocardial ischemia.[10] Though we have references of studies endorsing on individual drug usage, no studies were found on using the combination of Aspirin, Clopidogrel and Atorvastatin in community level and primary care level settings.

This is an attempt to describe the Idhayam Kappom Thittam program in Tamil Nadu in its initial phase of implementation to understand the feasibility and its usefulness in detecting cardiac illness for early intervention and thus improving the mortality and morbidity status due to heart attack.

Around one-fifth of those given with the emergency cardiac loading dose had a cardiovascular intervention and this explains the importance of providing the emergency cardiac loading dose during the Golden hour – first 60 mins of heart attack, at the first health contact itself in determining the outcome.

Also, it is to be noted that providing loading dose drugs to non-cardiac illnesses might have complications like

gastrointestinal bleeding, especially in older persons[12], and thus the regular orientation of the medical professionals on identifying ACS and the chain of referral especially expert opinion from district nodal cardiologists as per the program guidelines is to be ensured.

The total number of tablets can be brought down from 14 numbers to 7 numbers, if the tablet Atorvastatin can be supplied as 80mg tablets than 10mg tablets.

"Idhayam Kaapom Thittam" by the Tamil Nadu government is one of the pioneer programmes of the state. With the rise in non-communicable diseases and increasing cardiac deaths, this programme is another prototype programme for the entire nation which can be implemented by other states owing to the impact it can create on mortality, morbidity, and quality of life of every common man in Tamil Nadu.

The follow-up information on diagnosis and treatment of few patients are yet to be updated and hence those individuals were not included in the analysis. Further analysis to understand the implications of comorbidities like hypertension, diabetes and other factors are essential and can be taken up.

A mixed method study can also be done gathering more information on the symptoms experienced by the beneficiaries, time duration taken to reach the referred centres and initiation of treatment, to estimate the confidence level of the community level field workers in delivering the cardiac emergency loading doses and studies to estimate its cost effectiveness in reducing cardiac morbidity and mortality.

CONCLUSION

This study tries to give an idea of the high-risk category patients with chest pain who approach health centres for cardiac loading doses. Males between 45 and 60 years of age with hypertension are at the highest risk of having chest pain. Also, this study shows the importance of providing a cardiac loading dose at the first health contact itself in determining the outcome.

"Idhayam Kaapom Thittam" by the Tamil Nadu government is one of the pioneer programmes of the state and it goes a long way in showing the well-developed healthcare service delivery system and its effective functioning. With the rise in non-communicable diseases and increasing cardiac deaths, this programme is another prototype programme for the entire nation which will be implemented by other states sooner or later owing to the impact it can create on mortality, morbidity, and quality of life of every common man in Tamil Nadu.

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ORIGINAL ARTICLE - PUBLIC HEALTH

A STUDY ON ANALYSIS OF UTILIZATION OF ADOLESCENT FRIENDLY HEALTH CLINICS AMONG ADOLESCENT IN TAMIL NADU

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Abstract

INTRODUCTION : Adolescents aged between 10-19 years constitute 18% of the world population, i.e., about 1.2 billion. India has the largest number of adolescents comprising one-fifth of the country's population. Adolescent health and nutrition status has an intergenerational effect. Services for adolescents are highly fragmented, poorly coordinated and uneven in quality. Adolescent friendly health clinics (AFHC) are designed to make health services accommodate the unique needs of adolescents. With this background, the present study was carried out to study the utilization of adolescent friendly health clinics in last one year in Tamil Nadu

METHODOLOGY : The study was a secondary data analysis conducted among the adolescent attended the AFHC in the year 2023-24 in Tamil Nadu. Proportion was calculated and key performance indicators of AFHC was analysed.

RESULTS : About 5% of male and 6% female adolescent utilized AFHC in the state. Skin problem consultation and anaemia management, nutritional counselling, referral to ICTC services are the major services utilized by the adolescent. Only 34% of married adolescent used contraception.

CONCLUSION : Emphasis must be laid to create awareness & utilization of services among adolescents & their wards regarding AFHS. The health planners should make efforts to create a conducive environment for the adolescent by training the AFHS providers, particularly those who work in government institutions, and strengthening the awareness creation strategies among adolescents to increase the utilization of the services.

KEYWORDS : adolescent, utilization, friendly, clinics

INTRODUCTION

The World Health Organization defines adolescent as people of age lying between 10-19 years of age.[1] Adolescents consists of one by fifth of the population and their numbers tend to increase in future years. Out of 1.2 billion of adolescents living worldwide more than 90% of them live in developing country. 23% of Indian population is consist of adolescent population.[2]

Adolescence is a stage of rapid physical, mental and psychological growth and development. Many diseases of adulthood originates in adolescence period. Moreover, experimentation and exploration are the hallmark of adolescent behaviour leads to risk-taking exposures like unwanted pregnancy, HIV/AIDS and sexually transmitted disease, substance abuse and unintended injuries.[3,4] In case of health demands, the adolescent faces difficulties in seeking health services due to fear of disclosure, stigma and discrimination and perceived lack of respect. To overcome this challenge, it is important to develop a specific service designed for adolescent which attract the young people, meet their needs securely with continued follow up care. The service should be equipped with specially trained staffs with a comfortable and friendly clinic environment.[5]

The Rashtriya Kishor Swasthya Karyakram (RKSK)

was launched across India in 2014 by the Government of India to respond to the specific health needs of adolescents by providing Adolescent Friendly Health Services. The main objectives of the program is to enhance nutrition, to promote sexual and reproductive health, to improve mental health, to prevent injuries and violence, to mitigate substance misuse, and address conditions related to non-communicable diseases in the adolescents.[2]

In Tamil Nadu, this program aims to provide comprehensive health services for adolescents aged 10 to 19 years of age. This program targets adolescents of both genders, residing in urban and rural areas, whether in school or out of school, including married and unmarried individuals and those considered vulnerable or under-served. As on date 442 adolescent health friendly clinic were established in Tamil Nadu. The AFHC provides services to adolescent through Clinical services, counselling services, referral services and outreach services. Hence this study was conducted to assess

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the utilization of AFHC among the adolescents during the period April 2023- March 2024.

METHODOLOGY

The study was a secondary data analysis conducted among the adolescents attended adolescent- friendly clinics in Tamil Nadu during the period of April 2023 to March 2024 .The study population comprises of adolescents in the age group of 10 -19 years of both sexes.

A total of 610370 data of adolescents registered in the adolescent friendly health clinic was included in the study. The data was collected systematically on monthly basis from all the AFHC clinics located in Community Health Centres, District Headquarters hospitals, Sub-Taluk Hospitals and Medical colleges in Tamil Nadu by the statistical section of the Health Education Bureau department in the office of the Directorate of Public Health and Preventive Medicine, Chennai. The study data collected comprises of three section (i) number of established AFHCs till date (ii) socio-demographic details of the participants (iii) number of adolescents registered and utilized different types of services. The data was analysed using Statistical Package for the Social Sciences (IBM) software version 23 (IBM software groups and services, India).

The quantitative analysis were done and expressed in proportions. Since it is a secondary data analysis, wavering sought from the Institutional Ethical Committee.
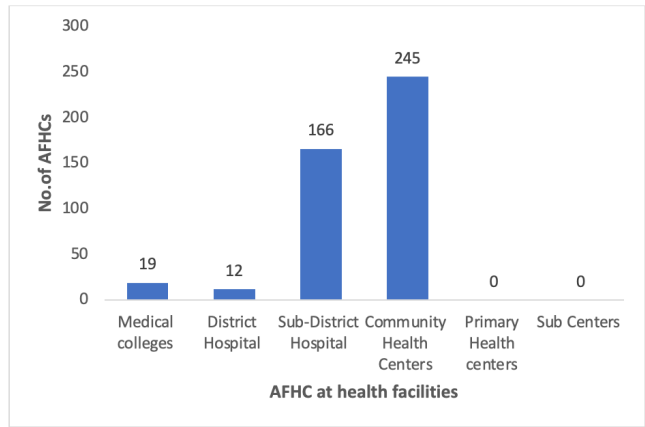
RESULTS

Figure 1: Distribution of Established Adolescent Friendly Health Clinics in Tamilnadu during the year 2023-24.

The above figure shows the establishment of the adolescent friendly health clinics in different public health sectors of Tamil Nadu as on 31.03.2024. 442 adolescent

friendly health clinics were established in the Government medical college hospitals, district hospital, sub –district hospitals and block PHCs and UCHC in corporations and in Greater Chennai Corporation.
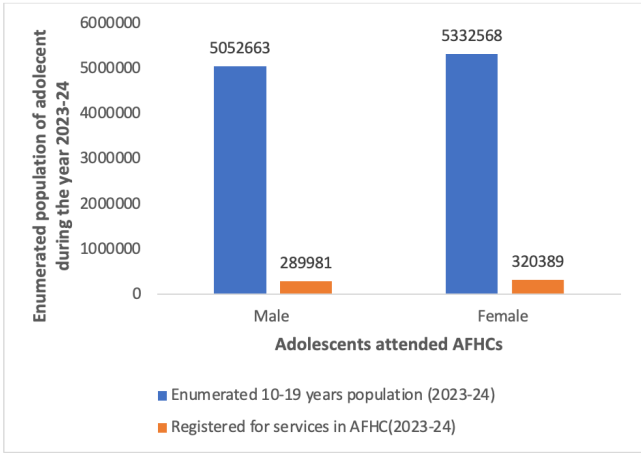

Figure 2: Distribution of utilization of AFHC by the adolescents of Tamil Nadu during the year 2023-24

When compared with enumerated population of adolescent in the year 2023-24 , only 289981(5%) adolescents in male and 320389 (6%) adolescents in females has registered and utilized the services in adolescent friendly health clinics.

Variable (N=610370)	Frequency	Percentage (%)
Age group (Years)		
10-13	164799	27
14-16	213629	35
17-19	231942	38
Sex		
Male	289981	48
Female	320389	52
Marital Status		
Unmarried	583935	96
Married	26435	4

Table 1: Distribution of Socio -demographic details of the adolescents registered in AFHC during the year 2023-24

About 44% in the age group of 10-14 years and 56% in the age group of 15-19 years has utilized the AFHCs. Majority of the services were utilized by the females (52%) when compared to males (48%). 1% of married adolescents were registered to the Adolescent clinics.

Skin problems (23%), management of anaemia-IFA tablets (23%), sexually transmitted disease management (9%) and menstrual problem management (9%) were the major clinical services utilized by the registered adolescents. Nutritional (35%) and skin related issue (2%) were the key counselling services opted by the adolescents in the clinics.

Table 2: Distribution of Clinical and Counselling services utilized by the adolescent at AFHC during the year 2023-24

Variable	Frequency	Percentage (%)
Clinical services (n=526919)		
Menstrual problems	47976	9
RTI/STI Management	49799	9
Skin problems	123277	23
ANC services	10208	2
IFA tablet	123609	23
Contraceptives	625	0
Immunizations	8527	2
Others	162898	31
Counselling services (N=601003)		
Nutrition	212449	35
Skin	131043	22
Pre-marital counselling	20292	3
Sexual problems	2492	0
Contraception	2763	0
Abortion	172	0
RTI/STI	45085	8
Substance abuse	1799	0
Learning problems	19830	3
Stress	16372	3
Depression	6840	1
Suicidal Tendency	806	0
Violence	1138	0
Sexual abuse	1094	0
Other mental health issues	2980	0
Others	135848	23

Among the referral services of AFHCs, majority of the adolescents were referred to ICTC (34%), skin OPD (13%) followed Obstetric and genecology issues (3%).
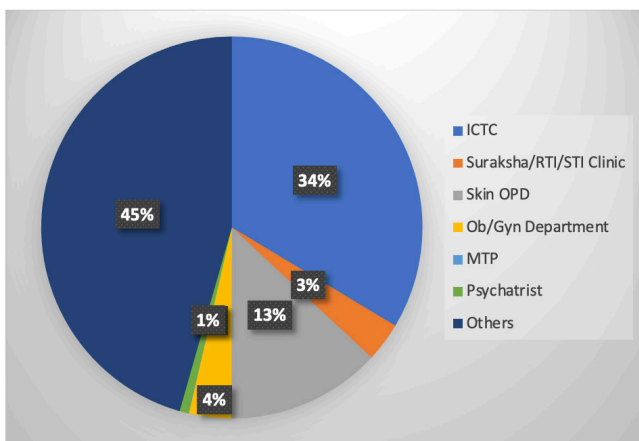

Figure 2: Distribution of referral services at AFHC during the year 2023-24, Tamil Nadu

The major outreach session for adolescent were conducted in schools and colleges by RBSK team (29%) followed in outreach camps conducted by Mobile Medical Units (MMU) teams (25%)and Village health sanitation and Nutrition day conducted by VHNs (27%).

Table 3 : Distribution of outreach services utilized by the adolescent during the year 2023-24

Variables (N=24146)	Frequency	Percentage (%)
At schools /Colleges	7516	29
In Outreach camps	5914	25
At village health Nutrition day	6378	27
HWC-Health Melas	3126	14
Youth clubs	1212	5
Vocational training centres	0	0
Youth festivals	0	0

The major outreach session for adolescent were conducted in schools and colleges by RBSK team (29%) followed in outreach camps conducted by Mobile Medical Units (MMU) teams (25%)and Village health sanitation and Nutrition day conducted by VHNs (27%).
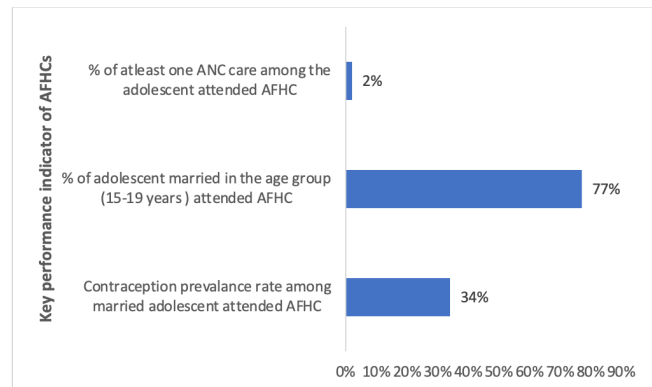

Figure 4 : Analysis of Key performance indicators of AFHC during the period 2023-24

As per the National Health Mission guidelines, the above three indicators are analysed quarterly. 86% of clinical services, 98% of counselling services and 10% of referral services were utilized by the registered adolescents during the period 2023-24. Among them counselling services are the major service utilized by the adolescents at AFHCs.

DISCUSSION

Our study found that there was lower utilisation of AFHC services among the study participants. The reason might due to efficient functioning of Health and wellness centres in villages and primary health centres, it covers adolescent services which is one of the important component of 12 comprehensive services. Moreover as per the results of National Family Health survey 2019-21, adolescent female (15-19 years) who seeks medical attention, counselling services or referral services are readily reached out by 11.6% by ANMs, 9.3% by Angawadi workers, 14.4% by ASHAs, 0.3% by MPH and 20.8% by any health worker.[6] Hence this

explains the utilization of AFHCs is lower in the state since the adolescents were addressed at the community level and referred to appropriate higher centres.

This study systematically evaluated the programme services has drawn the conclusions about their quality and their effects. On reviewing different studies conducted over India since 2000, it was found that services were primarily carried out by NGOs and academic institutions and have focused primarily on service utilization trends and less focussed on the service design and implementation of AFHS.[7,8] In previous studies, study designs most commonly used were descriptive or quasi-experimental in nature but lacked a comparison group to draw inferences on effectiveness of initiatives.9 Future evaluations and studies to be better designed and implemented and should pay more attention to process and long-term impact.

It is evident from the study reports that a standard approach to the evaluation of AFHC has not been adopted. The study recommends that future studies can adopt WHO Quality Assessment Guide book on AFHCs that could facilitate greater comparability across different studies and the results could be generalized to the entire population.[10]

This study suggest that most benefited strategy to improve utilization of AFHC is using a combination of approaches like health worker training and facility improvements as well as strategies for demand generation and community acceptance. A study conducted in LMIC country showed that above approach has improved the quality of health services to adolescents and their utilization.[11]

As per the guidelines of NHM, the study examines the key performance indicators of the programme (ie) clinical services, counselling services and referral services among the adolescent registered in AFHCs and proportion of outreach services utilized by the adolescents. But the study cannot measure the priority indicator of adolescent health due to data constraints. As per the study of Ahmed et al a set of key indicators has devised to comprehensively assess the adolescent clinics in South Asian countries.[12] It includes 7 indicators which covers mainly on assessment of nutrition, mortality, reproductive health, non –communicable diseases, infectious diseases, health behaviours and risks, demography and mental health. Each categories has 3 to 5 sub-categories which evaluates the utilization and efficacy of the AFHCs. Incorporation of above indicators in the evaluation of AFHCs can assist with identifying areas where further and more detailed assessments of health status and programming are needed.

From review from international studies, further studies should focus on essential domains of adolescent care like accessibility of health care, staff attitude, communication, medical competency, guideline-driven care, age-appropriate environments, youth involvement in health care, and health outcomes. More attention are needed on the strengths and weakness of different study and evaluation designs on AFHC.[13, 8]

CONCLUSION

The utilization of AFHC among adolescents can be improved by establishing specialized Adolescent friendly clinics across various platforms like schools, communities, health and wellness centres and tele health. Further the utilization can be improved by expanded AFHC establishment in all paediatric clinics at Government and private institutions. The barrier for utilization should be overcome by the 'friendly' components of AFHC in all specialty areas. Each specialty should have linkage and partnership with the AFHC and in the community. Specialty clinics like gynaecology, dermatology, pulmonology, endocrinology and nephrology could be conducted for adolescents on a weekly or biweekly basis to enable multidisciplinary care at the existing adolescent clinic in the hospital.

The adolescents have a misconception about AFHC that they may face lack of privacy, disrespectful and judgmental behaviour of health care staff. To overcome this hurdle, training for healthcare providers should include soft skills such as communicating with adolescents, maintaining their privacy and keeping their conversations in confidence and remaining non-judgmental during consultations

Making specified AFHC facilities available and providing privacy would be a short-term solution, which is also cost-effective and would improve utilisation AFHC services and higher satisfaction of the services. A long-term, yet effective solution would be community orientations to sensitise the importance of AFHC clinics and sensitization of adolescent towards sex education, addressing their sexual and reproduction needs and removal of the stigma.

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ORIGINAL ARTICLE - PUBLIC HEALTH

URINE DIPSTICK TESTING (UDT) AT COMMUNITY LEVELS – AN INITIATIVE BY THE GOVERNMENT OF TAMILNADU FOR EARLY DETECTION OF CHRONIC KIDNEY DISEASES – AN OVERVIEW

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Abstract

INTRODUCTION : Chronic kidney disease is the fifth leading cause of mortality in Tamil Nadu. As diabetes and hypertension rates increase, the burden of chronic kidney disease is expected to grow, impacting both health and the economy. In developing countries with limited dialysis and transplant facilities, early detection of chronic kidney disease can significantly reduce the risk of progression to end-stage renal disease and improve overall population health. The Government of Tamil Nadu has launched the 'Urine dipstick testing Program' for early detection of chronic kidney disease at all Primary Health Centers (PHC) and Health Sub-Centers (HSC) for the target patients.

OBJECTIVE : To understand the health profile of the beneficiaries under the Urine Dipstick testing program and their status of co-morbid conditions based on State data from July 2023 to May 2024.

METHODS : A descriptive study was done based on the secondary data analysis of the beneficiaries of the Urine Dipstick Testing (UDT) Programme for the period from July 2023 to May 2024 across all districts of Tamil Nadu.

RESULTS : A total of 57,23,188 beneficiaries have been screened under this program, of which 13,082 tested positive in the Urine dipstick testing. Among these, 6312 (48.3%) were found to be hypertensive, 4272 (32.7% were diabetics) and 2498 (19%) had both hypertension and diabetes. On referral, 946 persons (7.2%) were confirmed to have Chronic Kidney Disease (CKD) in various stages.

CONCLUSION : The Urine Dipstick testing program provides a crucial opportunity for individuals from high-risk populations, particularly those with hypertension and diabetes, to undergo thorough screenings for the early detection of kidney diseases.

KEYWORDS : Chronic Kidney Diseases, eGFR, Urine Dipstick Testing

INTRODUCTION

Chronic kidney disease (CKD) is a major public health concern worldwide. It is a slow progressive, and irreversible disease associated with a decline in the estimated Glomerular Filtration Rate (eGFR) (less than 60 mL/min/1.73 m2) for at least 3 months. There is a paucity of data on the prevalence of CKD in India, but the reported prevalence ranges from <1% to 17%.[1] Furthermore, with the increasing incidence of diabetes among younger Indians, the prevalence of CKD is expected to rise further as diabetes accounts for 40%–60% of cases of end-stage renal disease (ESRD).[1]

Chronic kidney disease is the fifth leading cause of mortality in Tamil Nadu. This means that Tamil Nadu needs special attention compared to most other states. A recent step survey conducted by the Institute of Nephrology and Institute of Community Medicine, Madras Medical College, estimated chronic kidney disease to be prevalent in 8.4% of the adult population of Tamil Nadu, and 0.3% will require dialysis immediately. With diabetes and hypertension increasing in the population, the burden of chronic kidney disease will only increase. This will impact not only the health of the people but also the economy.[2]

The basis for implementing urgent action on chronic kidney disease is improved patient outcomes through the identification of high-risk groups, resulting in targeted therapy implementation which subsequently would reduce the incidence of adverse and costly effects such as progression to end-stage renal disease, cardiovascular events, and mortality.[2,3]

Early detection of chronic kidney disease has a notable impact in developing countries where both dialysis and transplant facilities are severely limited; as such it is hoped to have an especially noticeable effect on curtailing progression to end-stage renal disease, with a general increase in overall population health due to the decreased development of comorbidities.[3]

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The Government of Tamil Nadu launched Urine dipstick testing for early detection of Chronic Kidney disease for NCD patients at the community level (Primary Health Centre/ Health Subcentre) on 10.07.2023, and all NCD patients who have hypertension and diabetes above 30 years are screened for Chronic Kidney Disease on priority basis. This study aims to understand the health profile of the beneficiaries under the Urine Dipstick testing program and their status of co-morbid conditions based on State data collected in the last ten months since the program's launch.

METHODS

This study involves a secondary data analysis of the Urine Dipstick Testing programme data for the period from July 2023 to May 2024 across all districts of Tamil Nadu and the study population includes all the Urine Dipstick Testing (UDT) Programme beneficiaries in Tamil Nadu in that period.

The data is compiled in an Excel version with the various details of the beneficiaries as a line list. The list contains the basic demographic details of the beneficiaries, such as age, gender, and address.

The next part contains details about the comorbid status of the beneficiaries such as Hypertension, diabetes, Both Hypertension and diabetes, smoking, and alcoholism. The final part contains the details of the referral and suspected/confirmed status at a higher health facility.

After data cleaning, analysis was done using the Statistical software SPSS version.[16] All categorical variables were expressed as frequencies, percentages, and proportions. All continuous variables were expressed as mean and standard deviation. The test of significance used was the chi-square test. The test was found to be significant if p-value <0.05.

RESULTS

A total of 57,23,188 beneficiaries have been screened under this program, of which 13,082 (0.2%) tested positive in the Urine dipstick testing. Of those 13,082 tested positive and referred, 946 (7.2%) were confirmed to have Chronic Kidney Diseases (CKD).

The gender distribution of the beneficiaries under the urine dipstick testing program shows equal representation of both males and females. 6312 (48.3%) were found to be hypertensive, 4272 (32.7% were diabetics) and 2498 (19%) had both hypertension and diabetes. About 1501 (11.4%) of the study population were smokers and 1561 (11.9 %) of the study population were alcoholics. (Table 1)

Table 1: Characteristics and test results of the persons who were tested positive in the Urine Dipstick Testing Program, July 2023 to May 2024, Tamil Nadu

Characteristics		Frequency N (N= 13,082)	%
Gender	Male	6629	50. 7%
	Female	6453	49.3%
Comorbidities	Hypertension	6312	48.3%
	Diabetes mellitus	4272	32.7%
	Both HTN & DM	2498	19%
	Smokers	1501	11.4%
	Alcoholics	1561	11.9%
Urine Dipstick Test Result	1+	8574	65.5%
	2+	3549	27.1%
	3+	818	6.3%
	4+	141	1.0%

The results of urine dipstick testing done for 13,082 persons who tested positive show 8574 (65.5%) to be with 1+, 3549 (27.1%) to be 2+, 818 (6.3%) to be 3+, and 141 (1.0%) were 4+.

Table 2: Chronic kidney disease diagnosed in the Urine Dipstick Testing Program, July 2023 to May 2024, Tamil Nadu

Urine Albumin	No. tested positive (N= 13,082)	No. Confirmed with CKD	% Confirmed with CKD
1+	8574	399	4.7
2+	3549	367	10.3
3+	818	152	18.6
4+	141	28	19.9
TOTAL	13,082	946	7.2

Among the total beneficiaries of the Urine Dipstick Testing Program, about 7.2% (946) of them were confirmed to have Chronic Kidney Disease (CKD) at a higher facility based on Renal function tests, Ultrasound abdomen, and eGFR.

Of 818 persons who had 3+ in the urine dipstick test, 152 (18.6%) were confirmed to have CKD while of 141 persons who had 4+ in the urine dipstick test, 28 (19.9%) were confirmed to have CKD.

The distribution of diagnosed CKD cases by HUDs are given in Table 3. Cuddalore, Villupuram, Kanniyakumari had highest number of CKD case distribution.

Table 3: Health Unit District-wise Chronic Kidney Disease diagnosed under the Urine Dipstick Testing Program, July 2023 to May 2024, Tamil Nadu

Health Unit Districts	Number of Chronic Kidney diseases diagnosed (N=946)	Percentage out of total diagnosed
Cuddalore	115	11.4%
Villupuram	83	8.3%
Kanniyakumari	67	6.7%
Ariyalur	57	5.7%
Kallakkurichi	55	5.5%
Tiruppur	54	5.4%
Chennai	45	4.5%
Thiruvallur	43	4.3%
Attur	42	4.2%
Dindigul	42	4.2%
Chengalpattu	31	3.1%

Poonamallee	29	2.9%
Tenkasi	27	2.7%
Nagapattinam	24	2.4%
Thoothukkudi	23	2.3%
Kovilpatti	19	1.9%
Krishnagiri	19	1.9%
Palani	18	1.8%
Tiruchirappalli	17	1.7%
Perambalur	17	1.7%
Theni	16	1.6%
Pudukkottai	15	1.5%
Karur	15	1.5%
Paramakudi	10	1.0%
The Nilgiris	10	1.0%
Virudhunagar	10	1.0%
Tirunelveli	9	0.9%
Kancheepuram	9	0.9%
Thanjavur	9	0.9%
Vellore	8	0.8%
Salem	8	0.8%
Thiruvarur	8	0.8%
Mayiladuthurai	6	0.6%
Ramanathapuram	6	0.6%
Sivaganga	6	0.6%
Aranthangi	5	0.5%
Cheyyar	5	0.5%
Tiruvannamalai	5	0.5%
Tirupathur	4	0.4%
Erode	4	0.4%
Ranipet	3	0.3%
Coimbatore	2	0.2%
Madurai	2	0.2%
Sivakasi	2	0.2%
Dharmapuri	1	0.1%
Namakkal	1	0.1%

DISCUSSION

This study shows that out of a total of 13,082 people who were tested and found as a suspect using the Urine Dipstick Testing Program, 946 (7.2%) were confirmed to have Chronic Kidney Disease in various stages based on their eGFR estimation. In a large group of patients with high blood pressure, it is crucial to identify those with signs of organ damage, as they are at higher risk for heart and blood vessel-related health issues. Testing for microalbuminuria using a dipstick on a urine sample is a quick, accurate, and convenient method for patients.[4,5,6] The prevalence of microalbuminuria among individuals with hypertension varies significantly, with estimates ranging from 6% to 40%. This variation depends on the severity and duration of hypertension in the patients.[7] In this study, 48.3% of the total who had tested positive in urine dipstick testing had hypertension. Dipstick testing is commonly used to screen for kidney disease in people with conditions like diabetes and hypertension, which can greatly increase the risk of developing kidney issues. Both conditions have varying levels of severity, often do not present symptoms, and affect a significant portion of the adult population.[8]

One of the indicators among the WHO NCD-related tests and procedures in primary healthcare settings is the general availability of urine testing for albumin.[9] Albuminuria, the presence of excessive amounts of the protein albumin in the urine, is an important indicator of kidney damage. It is strongly associated with a heightened risk of cardiovascular diseases, a rapid deterioration in kidney function, and an increased likelihood of overall mortality.[10,11,12] The urine dipstick test, a method that has been in use for over 50 years, is utilised for the detection of albuminuria.[13] The dipstick contains multiple pads with chemical reagents to assess specific urine characteristics.[14] The dipstick test for urinary protein primarily detects albumin and can be utilised to semi-quantitatively assess albuminuria.[15]

In this study, 818 reported as 3+ in the Urine Dipstick test of which 152 (18.6%) confirmed to have CKD while 141 reported as 4+ in the Urine Dipstick test of which 28 (19.6%) confirmed to have CKD. The urine dipstick is utilized to support CKD screening programs due to its simplicity, cost-effectiveness, and ease of use.[15,16]

The presence of albumin (and other proteins) in urine is an accepted indicator of the presence and severity of chronic kidney disease (CKD), and regular monitoring of the urine of patients in the early stages of CKD may be quite useful in detecting responses to medical/lifestyle management, as well as detecting the progression of the disease.[17]

This program provides a crucial opportunity for individuals from high-risk populations, particularly those with hypertension and diabetes, to undergo thorough screenings for the early detection of kidney diseases. By identifying potential issues at an early stage, individuals can access timely interventions and treatments, ultimately leading to better health outcomes.

However, it is to be noted that the persons who had 3+ and 4+ in the Urine dipstick test and not found to have CKD on further confirmatory tests should be followed up with monitoring of their co-morbid status like hypertension and diabetes ensuring its control. 4.7% of those who had 1+ in Urine dipstick are diagnosed to have CKD which has to be further studied on a case-to-case basis so as to assess any other factors including time of reporting to the referral facility and subjective errors.

Urine dipstick is a highly specific (97 – 100%) method for detecting proteinuria, however, the sensitivity of the test for detecting low-end, but clinically significant proteinuria is reported to be 32 – 46%.[19] Therefore in people diagnosed with, or suspected of having diabetes, a more sensitive technique, i.e. albumin:creatinine ratio

(ACR), is recommended to quantify proteinuria.18 Recent advancement by estimating glomerular filtration rate (eGFR) may be explored considering the limitations of interpreting plasma creatinine alone, the cost and complexities of determining a gold standard GFR with either inulin or radionuclides, and the inaccuracies inherent in measuring a 24 h urine creatinine clearance.

CONCLUSION

This study aims to provide an overview of the status of Chronic Kidney Disease in Tamil Nadu following the introduction of the Urine Dipstick Testing program. Those individuals tested positive in UDT and not diagnosed with CKD are to be followed up for necessary confirmation of the disease and further studies like cohort follow-up may be attempted. In the future, a comprehensive analysis of the program's beneficiaries through a qualitative study will be done to understand the benefits and the impact of the intervention.

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Manuscripts submitted at our website **www.tnjphmr.com** will be reviewed for possible publication with the understanding that they are being submitted to one journal at a time and have not been published earlier or under simultaneous consideration for publication by any other journal. Upload the text of the manuscript, tables and individual figures as separate files. All manuscripts submitted will be duly acknowledged, however the journal will no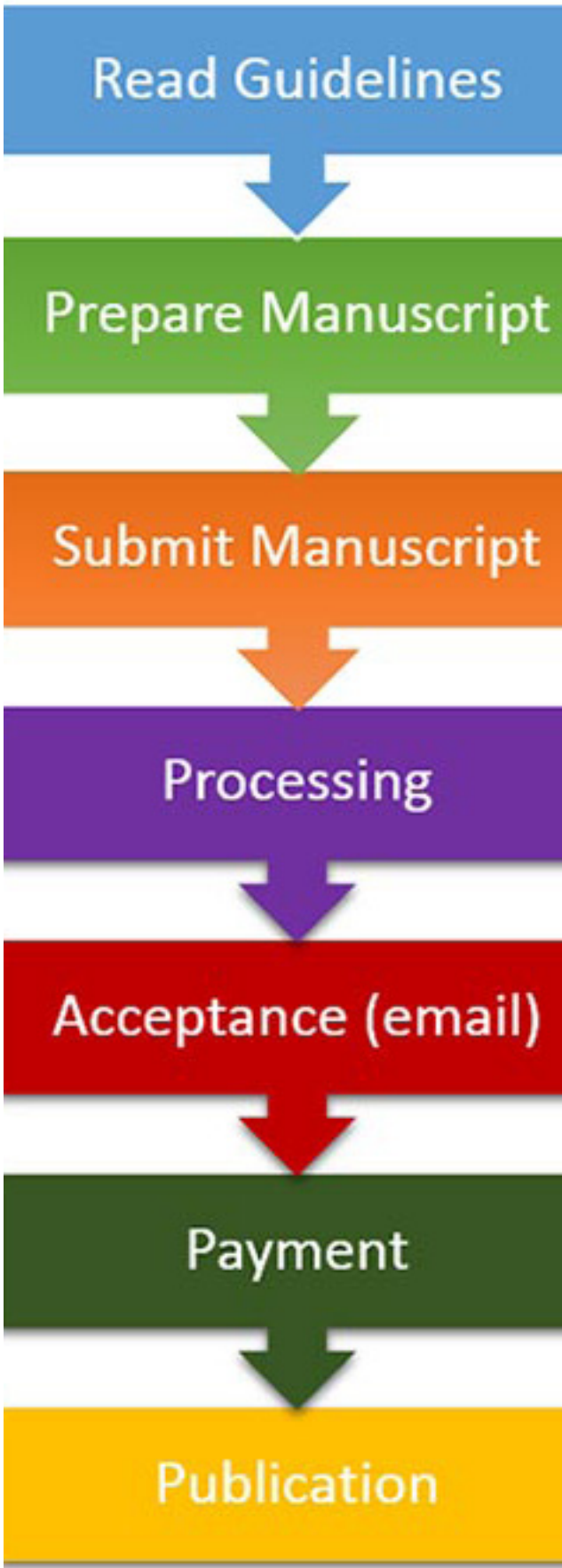t return the unaccepted manuscripts. Each manuscript received will be assigned a manuscript number, which must be used for future correspondence. All articles (including invited ones) will be usually evaluated by peer reviewers who remain anonymous. The authors will be informed about the reviewers' comments and acceptance/rejection of the manuscript. Accepted articles would be edited to the Journal's style. Proofs will be sent to the corresponding author which has to be returned within one week. Accepted manuscripts become the permanent property of the Journal and may not be reproduced, in whole or in part, without the written permission of the editor.

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